Lawrence Livermore National Laboratory

Hazards Control Department

1996

Energy Quality Award Application

Contents

Glossary

AA	Affirmative Action
ACGIH	American Conference of Governmental Industrial Hygienists
AD	Associate Director
ALARA	As low as reasonably achievable
ANSI	American National Standards Institute
APP	Accident Prevention Program
ARG	Accident Response Group
BLS	Bureau of Labor Statistics
CAD	Computer-aided dispatch
CBT	Computer-based training
CCI	Cost Cutting Initiative
CQI	Continuous quality improvement; also TQM
CSL	Standards and Calibration Laboratory
DAD	Deputy Associate Director
DNFSB	Defense Nuclear Facility Safety Board
DOE	Department of Energy
DOELAP	DOE Laboratory Accreditation Program
EDC	Emergency Dispatch Center
EH	Environmental Health
E-mail	Electronic mail
EMD	Emergency Management Division (in HCD)
EMT	Emergency Medical technician
EPD	Environmental Protection Department
ES&H	Environmental, Safety, and Health
ET&SA	Education, Training, and Safety Analysis
FSP	Facility Safety Procedures
FTE	Full-time equivalent employee
G&A	General and Administrative
GERT	General Employee Radiological Training
GPO	Government Printing Office
H&S	Health and safety
HCD	Hazards Control Department
HE	High explosives
HEPA	High-efficiency particulate air
HPT	Health Physics training
HR	Human Resources
HSD	Health Services Department
IEEE	Institute of Electronic and Electrical Engineers
LANL	Los Alamos National Laboratory
LBNL	Lawrence Berkeley National Laboratory

LEDO	Laboratory Emergency Duty Officer
LIMS	Laboratory information management system
LLNL	Lawrence Livermore National Laboratory
MIST	Management Information Systems Team
MSDS	Material Safety Data Sheet
NAI	Non-Proliferation Arms Control and International Security Directorate
NCRP	National Committee for Radiation Protection
NEST	Nuclear Emergency Search Team
NFPA	National Fire Protection Association
NIST	National Institute for Standards and Technology
NRC	Nuclear Regulatory Commission
OES	Office of Emergency Service
OJT	On-the-job training
OSHA	Occupational Health and Safety Administration
OSP	Operational Safety Procedure
PAT	Process Action Team
PBT	Performance-based training
PHA	Preliminary Hazards Analysis
PI	Principal investigator
QA	Quality assurance
QC	Quality control
QM	Quality management
R&D	Research and development
RadCon	Radiation control
RMI	Repetitive motion injuries
RML	Radiological Measurements Laboratory
SAR	Safety Analysis Report
SKA	Skills, Knowledge, and Abilities
SMWT	Self-managed work team
SPD	Special Projects Division (in HCD)
STAR	Sample tracking and report system
STOG	Standardized training oversight groups
TQM	Total quality management
TRADE	Training resource and data exchange
TSD	Training system development
TSPDD	Technical Support and Policy Development Division
UBC	Uniform building code
UC	University of California
USEC	U.S. Enrichment Corporation
WBE	Work budget element
WBT	Web-based training

Overview

The Lawrence Livermore National Laboratory (LLNL) is a U.S. Department of Energy (DOE) research and development facility operated by the University of California (UC). It is a nationally recognized research laboratory, focusing on the application of science and technology in the national interest. The Laboratory's mission is dynamic and changes to meet new national needs. The Hazards Control Department (HCD) is an integral part of the LLNL Environmental, Safety, and Health (ES&H) program. It currently has 283 employees who provide health and safety support for the nearly 10,000 individuals who work at the Laboratory each day.

The HCD is a changing, evolving organization that seeks better ways to help the LLNL maintain a safe working environment. Taking a proactive attitude toward prevention of accidents, the department emphasizes using teams, empowering employees, minimizing internal structure and bureaucracy, and providing useful and timely training and information to employees and customers.

Mission, products, and services

The HCD mission is to function as a leader to integrate the minimization of risk and the control of workplace hazards into the thought, plans, and actions of Laboratory management and employees.

The department provides products and services in the following broad categories: safety guidance, technical support, emergency management, and safety research and development.

- Safety guidance includes the development, publication, and distribution of safety policies, standards, and procedures. Guidance also includes developing specific safety-related procedures and providing safety advice and assistance on operations to program customers.

- Technical support includes educating and training of personnel; performing laboratory analyses of personnel and workplace samples; monitoring and reporting on the safety of program operations and facilities; and providing protective and monitoring equipment.

- Emergency management encompasses laboratory-wide response to emergencies by processing and handling alarms, deploying emergency response resources, and mitigating emergency situations.

- Safety research and development (R&D) is based on customer needs for safety-related information and products. Filter development and fire safety are two areas of specific expertise.

History of when and why Quality Management was implemented

Over the years HCD has developed expertise and established safety procedures in controlling the hazards associated with new technology. Our expertise has been cited by the DOE as excellent and progressive.

The department anticipated the need to change in order to respond to the challenges of a changing environment. HCD's primary focus was on the evolving LLNL mission, projections of reduced funding, increased emphasis on ES&H issues, and a desire to create a more proactive health and safety (H&S) culture at LLNL.

With the goal of a proactive safety culture where accidents are not tolerated, George Campbell, Department Head, launched the Accident Prevention Program (APP) in April 1993. The APP is the term used for quality improvement in HCD.

Customer concerns, budget considerations, and regulatory issues were major factors to be considered. A small-scale survey of customers identified several areas where department efforts could be improved. *Ad hoc* committees addressed such issues as employee skills, knowledge and abilities; department trust; risk and regulation; communication with customers and employees; department purpose, mission, and vision; and how to optimize efforts. Drivers and constraints were identified, and goals and actions were established. During the process, HCD also had to consider the effects of a UC retirement incentive designed to offset projected-budget cuts. The APP introduced formal strategic planning, self-managed work teams (SMWTs), and employee standing committees to the department.

Now, three years later, the department is a flatter, more responsive, employee-driven organization with three clear goals: customer satisfaction, ES&H excellence, and effective teamwork.

Principal customers

HCD's primary customer is Lawrence Livermore National Laboratory, although the department does additional work directly for DOE and other agencies. The customer groups are:

- Institutional—Outlook or responsibility for the Laboratory as an entity
- Programs —Responsibility for various research and support organizations at LLNL
- Field—LLNL employees conducting day-to-day research and development (R&D) and support functions
- Other —Customers external to LLNL who are primarily from other governmental agencies or organizations (e.g., DOE, Department of Defense, U.S. Enrichment Corporation, Nuclear Regulatory Commission), and who fund efforts of the department's Special Projects Division (SPD). In the area of emergency services, or where HCD has special capabilities, manpower, or expertise, customers may also be surrounding communities, other national laboratories, industrial collaborators, or federal, State or local government entities.

Customers' quality requirements

HCD must balance the quality requirements of different customer segments with budget factors and technical requirements (i.e., regulations, orders, policies):

- The institutional customer requires successful compliance with DOE contract performance measures as well as timely and accurate guidance regarding federal and State regulations that may affect operation of the Laboratory
- Program customers require efficient and effective advice and support to responsible line managers to help maintain a minimal-risk work environment
- Field customers require timely and effective response to emergencies, field support, and safety training
- Other organizations require expertise in diverse areas of safety and health R&D.

Types and numbers of principal suppliers

Because of the specialized nature of HCD's business, the number of suppliers is limited to qualified and/or certified vendors. Principal suppliers are those who provide specialized laboratory equipment, emergency medical and fire-fighting equipment, and protective and monitoring equipment for personnel.

Laws/regulations that significantly affect operations

HCD maintains compliance with literally hundreds of federal and State regulations, DOE Orders and Directives, local ordinances, State and national codes and standards. Proposed or likely future changes must be monitored to evaluate and respond to these new requirements. Unique hazards at LLNL and issues of public perception require special emphasis on regulations that cover nuclear safety and protection from radiation and hazardous chemicals.

Major new thrusts or challenges

The department's ongoing challenge is to continue to supply efficient, cost-effective safety services and guidance to customers in a climate characterized by continuously decreasing funding. New initiatives involving federal rules, DOE Orders, requirements, and audits entail compliance without identified funding in place. The role of the Laboratory, and therefore of the Hazards Control Department, is to rapidly respond in an effective manner to an ever-changing environment.

Organizational structure

As part of the quality initiative, the organization was restructured to eliminate all but one layer of management between any employee and Senior Management. This structure facilitates employee empowerment by minimizing internal structure and bureaucracy. Employee participation in the quality process is encouraged through the use of self-managed work teams, standing committees, and technical leaders. The ES&H Teams are housed in the customer facilities, and interact with the customers on a daily basis. The teams are specifically aligned with the customer organization's specialized needs.
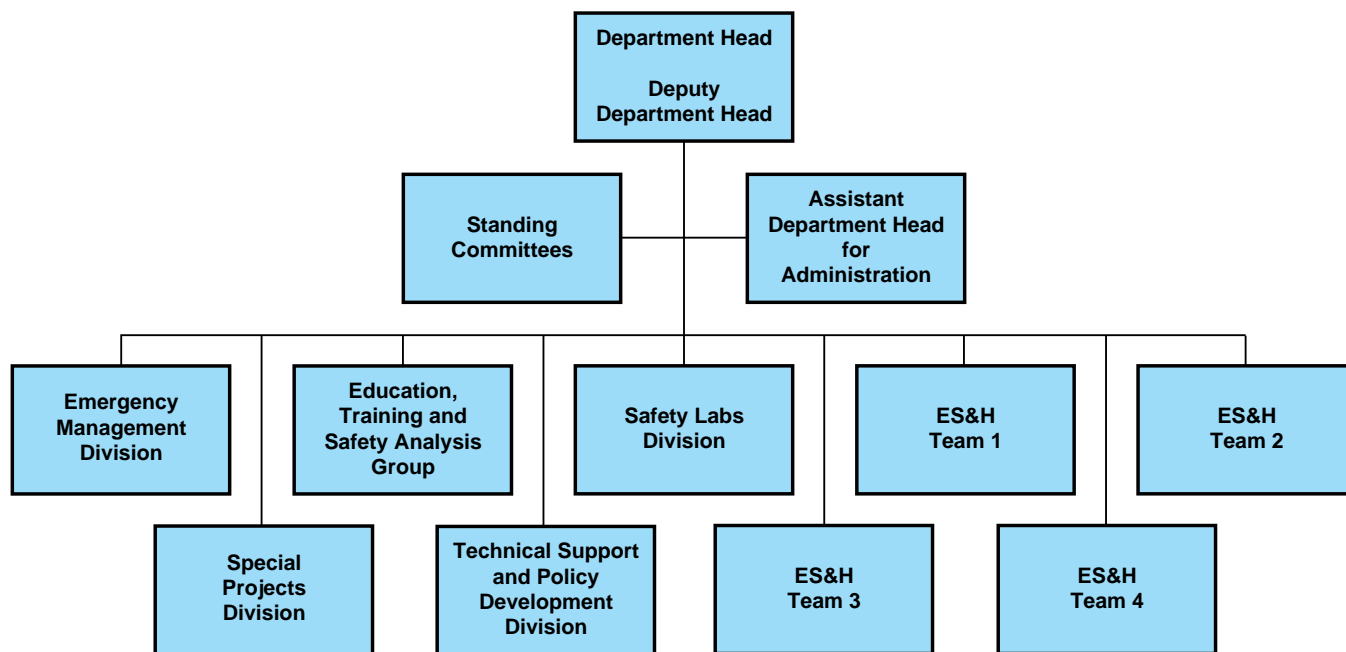

Figure 1. Organization chart for the Hazards Control Department at LLNL.
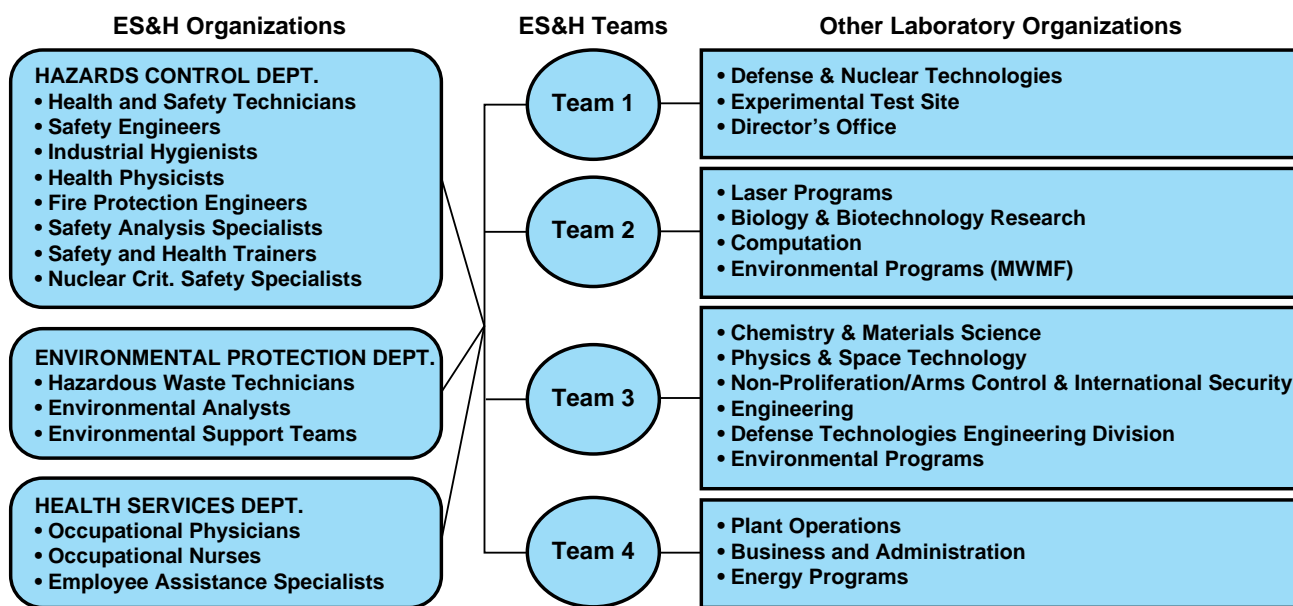

Figure 2. Teams of specialists and technicians provide services to the LLNL programs and overhead organizations.

Accomplishments

Improving emergency response saved four lives

In 1994, the Emergency Management Division (EMD) instituted a program to significantly improve the level of medical assistance it provides. All firefighters, who were previously qualified as Emergency Medical Technicians (EMTs), were trained and certified as paramedics. During the first six months after this training, the new firefighter/paramedics saved four of five individuals in full cardiac arrest. The paramedic program, with its associated training time of 1200 hours per person, was completed with no additional funding.

Hyperlinking H&S and compliance manuals averts cost of $2.8 million

In 1995, the HCD implemented an electronic version of the *H&S Manual*. Publishing this document electronically with hyperlinks to the *Environmental Compliance Manual* and companion documents averted an estimated $2.8 million, the cost to develop and publish a combined, hardcopy *ES&H Manual*. It is easier for employees to consult the original source of regulations and review subjects online because subject matter in the electronic *ES&H Manual* is linked to OSHA, DOE, and other documents. In addition to being of service to LLNL employees, the electronic *ES&H Manual* is used by other DOE organizations and laboratories.

Converting the *RadCon Manual* averts cost of $2 million per year

HCD spearheaded the conversion of the DOE *RadCon* (Radiation Control) *Manual* from a compliance document to a guidance document, with support from UC, Los Alamos National Laboratory (LANL), and Lawrence Berkeley National Laboratory (LBNL). This allowed HCD to implement the *RadCon Manual* in a cost-effective manner at LLNL and at other DOE contractor sites as well. The cost averted is estimated to be $2 million each year at Livermore alone.

Putting training on the World Wide Web

HCD applied the new Internet technology to training. This technology is highly user friendly, providing desktop just-in-time training. HCD trainers have prepared several courses and placed them on the LLNL Training Home Page. It is not yet common to find interactive Hazards Control training with online testing on the Web. HCD personnel made a presentation describing these new classes at the 1995 Training Resource and Data Exchange (TRADE) conference. TRADE has now included the www address of the LLNL Training Home Page in their list of training sites.

Streamlining health and safety instruction saves thousands of hours

Employees complained about the requirement to repeat an introductory course periodically in order to remain qualified for duty. In response, HCD developed a short refresher course and validated it against the introductory course. This year, several more refresher courses were developed by the instructors. Typically, these are no more than half as long as the corresponding introductory course and save about 50 labor hours per class. In the new Radiation Control Technician course, trainers have been especially careful to tailor the course so technicians can complete the material by several methods, including self-study, computer-based training (CBT), and seminars. This has been so successful that approximately 4600 labor hours of classroom training have been avoided. In addition, by keying to the technicians' strengths, the time commitment is about 3 1/2 times shorter than the same training presented at other DOE contractor sites.

Radiological worker training was modularized to avoid repetition and tailor training to the hazards encountered by the worker. This training approach has been adopted in DOE EH-52. Subsequently, the DOE Standardized Training Oversight Group (STOG) was instructed to modify their Radiological Worker core training to reflect the LLNL approach.

Another example of a needs analysis that led to a cost savings involves the General Employee Radiological Training (GERT). Publishing the GERT handbook every other year rather than giving standard training saves an anticipated $250,000 per year in manpower.

Collaborating on the Belarus Mobile Laboratory

The SPD, in collaboration with the Non-Proliferation Arms Control and International Security Directorate (NAI) at LLNL, designed and fabricated a self-contained, complete mobile radiation measurement laboratory for the former Soviet Republic of Belarus. The Belarus Mobile Laboratory was specifically designed to monitor radiation from an accident, should one occur, involving dismantlement of nuclear weapons. The trailer is equipped with radiation measurement equipment and the supplies needed to collect samples and measure radiation levels. The mobile laboratory is designed to be transported and used for field measurements of contaminated areas.

Collective radiation dose decreased from 30 to 11 person-rem

The Laboratory has a continuing and aggressive program to minimize occupational radiation doses to its employees. In 1993, the radiation protection of workers became one of the UC-DOE contract performance measures for which Hazards Control has the primary oversight responsibility. Since that year, the collective annual external radiation dose has decreased from 30 to 11 person-rem. Although some of the reduction is the result of decreased workload, much of it is attributable to the dose reduction procedures that were developed by HCD and implemented by the programs during the inventory reduction effort in the Plutonium Facility.

Only 3 in 3000 hazardous chemical measurements exceed threshold limit values (TLVs)

HCD performs Industrial Hygiene exposure assessments to anticipate, recognize, evaluate, and control potential workplace hazards, and thus assure a safe and healthful work environment. In April 1995, HCD published an *Exposure Assessment and Monitoring Plan* to provide a consistent, systematic framework with which to evaluate and respond to workplace conditions. During 1995, out of nearly 3000 measurements, only three worker exposures exceeded the TLVs for hazardous chemicals. There were no significant health effects associated with the exposures to these three workers.

Ergonomic injuries reduced by factor of 2

In 1993, HCD identified the three most frequent types of injury. UC and LLNL management incorporated a reduction of these injuries as a contract performance measure. The three types are repetitive motion injuries at workstations and back and other overexertion injuries. A comparison standard was established for these injury types by reviewing data from 1991–93. In the initial phases of the corrective action plan developed to reduce these injuries, Hazards Control acted as a catalyst to increase management and employee awareness. The department has performed more than 500 workstation evaluations per year since 1992, conducted ergonomics safety training classes, prepared *Newsline* articles, and evaluated new ergonomic equipment. As measured by lost and restricted workdays, the severity of these injuries decreased by a factor of 2 between 1993 and 1995.

New steel HEPA filter could save DOE $22 million

SPD is continuing its development of a cleanable, steel, high-efficiency particulate air (HEPA) filter. Compared with the present glass-fiber HEPA filters, a steel HEPA filter is much more reliable and much stronger, which allows it to be cleaned in place. In-place cleaning will reduce worker exposure to radioactivity during filter changes and could save DOE $22 million each year based on current usage.

1.0   Leadership

1.1   Senior executive leadership

In April 1993, George Campbell, the Department Head, launched a CQI process called the Accident Prevention Program. He challenged the department's managers and employees to meet the changing needs of LLNL by changing their traditional way of doing business. His objective was to move from a department viewed as staid and bureaucratic to one that is motivated, responsive to customer needs, and continually improving.

1.1a(1) Creating and reinforcing values and expectations. In keeping with his strong belief in an employee-driven organization based on teamwork and empowerment, Campbell encouraged managers and employees to work with him to build an organization that would provide high quality health and safety services to its customers. The expectations for this improvement process were: (1) customer satisfaction, (2) ES&H excellence, and (3) effective teamwork. These became the department's three key business drivers.

Initially, *ad hoc* committees composed of department managers and employees proposed new approaches for the Accident Prevention Program and made recommendations. The following core values and beliefs were identified through employee surveys and adopted by Senior Management:

- Every employee has the right to a safe and healthful work environment
- Preventing accidents and illnesses, minimizing risk, and encouraging wellness are the most effective way to achieve safety
- Customers are the number one priority
- An individual's integrity is paramount
- Sharing information, open communication, and cooperation between employees are critical to success
- Optimizing the unique aspects of each individual produces the most effective workforce
- Creating and innovating constitute the cornerstone of the department's future.

Key components of the APP were customer satisfaction and employee empowerment. These were addressed by the initiation of Self-Managed Work Teams (SMWTs) through which employees make more of the decisions and at a level much closer to the customers. The existing ES&H Teams became self-managed units. To further strengthen the team organization, functional experts were added to the teams, assigned to specific customers, and physically located in the customer's facilities.

Senior Management, working with managers and employees, also defined the following Purpose, Mission, and Vision:

> **Purpose.** *To foster a working environment at LLNL where every person has the means, ability, and the desire to work safely.*
>
> **Mission.** *To function as a leader to integrate the minimization of risk and the control of workplace hazards into the thoughts, plans, and actions of Laboratory management and employees.*
>
> **Vision.** *The individuals in Hazards Control will enhance the mission of LLNL and its programs by being an integral part of each program and by participating in the planning and execution of existing and new experiments, and the design, construction, and maintenance of equipment and facilities. The professional expertise of our department and the personal integrity of its individual members will be held in the highest esteem by our Laboratory colleagues, the University of California, agencies of the government, and the general public. We will be a center of excellence and advancement in the field of occupational health and safety.*

Senior Management constantly reinforces the values of the department throughout the organization by a variety of means:

- New employees attend an orientation class where the values, purpose, mission, and key drivers of the department are discussed by a Senior Manager, usually the Department Head
- Quarterly all-hands department meetings, led by the Department Head, reinforce values and describe progress towards goals
- Monthly Leadership Team attends off-site meetings to discuss and, if necessary, make changes to better reflect the values and goals of the department
- Leaders and employees receive training related to department values (e.g., to date, SMWT training, TQM classes, Covey training, and Diversity training).

1.1a(2) Setting directions and performance goals. Senior Management ensures that the three key business drivers continue to challenge us to set dynamic goals and objectives in the strategic planning process. These goals and objectives shape each year's plan and are used to assess individual performance. Improvement strategies, future outlook, and status of goals are examined on a regular basis through group and individual meetings discussed below.

The department strives to improve both quality and services. Performance excellence goals are continually addressed by the Employee Rewards Standing Committee and the Skills, Knowledge, and Abilities (SKA) Standing Committee, and are integrated into individual performance assessments.

1.1a(3) Reviewing company performance. To monitor progress and to hold the focus on the key business drivers, the Senior Managers review the department's performance, capabilities, and organization as an integral part of planning and conducting the following meetings:

- Monthly, all-day Leadership Team meetings (generally off site) that cover
    - Improvement strategies and future outlook
    - Progress on strategic plan goals
    - Employee recommendations from Standing Committees
    - Customer and employee satisfaction data
    - Budget and performance goals.
- Biweekly meetings with the leader and deputy leader of each division to review performance, operational, and financial information and identify items for the monthly meeting
- Weekly Leadership Team meetings to review and develop responses to pertinent ES&H issues and internal department management issues
- Immediate as-needed review meetings with appropriate Leadership Team members for root cause analysis of any notable occurrences.

1.1b   Evaluate and improve the leadership system

HCD operates in an environment in which timeliness, versatility, high quality, innovation, and cost effectiveness in the delivery of services are paramount, and the department seeks out and implements improvements in the leadership system. Senior Management makes an ongoing effort to assess the effectiveness and success of their approach to leadership that includes:

- Biennial review of the department by a Management Peer Review panel—Includes ES&H managers from industry and academic institutions
- Comparison with other UC-operated national laboratories (LBNL, LANL)—Department and Deputy Department Heads meet with their counterparts to discuss, review, and compare ES&H department management systems
- Annual employee survey—Feedback on the leadership's commitment to core department values and employee perspectives on department leadership
- Periodic half-day internal program reviews conducted by the Department Head—Each division reviews its functions and services and discusses the issues and challenges that it faces in the short and long run
- Formal management letter (part of performance appraisal) from each division leader—Sets out the year's accomplishments and goals for the coming year
- Upward performance evaluation of each division leader by his/her employees.

These evaluations give direction to HCD leadership training efforts, which include:

- Leadership, quality, diversity, and customer service training for members of the Leadership Team (e.g., Covey philosophy, Malcolm Baldrige Criteria Training)
- Improvement in ES&H management skills through management conferences, workshops, continuing education courses, and participation in national professional societies
- Team member training for SMWTs.

1.2 Leadership system and organization

1.2a How values, expectations, and directions are integrated

The department leadership system consists of the Senior Managers and the Leadership Team. The various Standing Committees serve as resources to the leadership in resolving departmental issues, and Technical Leaders provide technical expertise in their respective H&S fields but have no supervisory responsibilities. The roles and responsibilities under the leadership system are described below and in Table 1.2.1.

1.2a(1) Customer focus. The department was restructured in 1993 from a hierarchical to a flat organization with only one level between the employees and the head of the department. The Standing Committees, Technical Leaders, and SMWTs are an integral part of the organizational structure. This leadership system was selected to promote and maintain the values, beliefs, philosophy, and commitments of the Accident Prevention Program.

Table 1.2.1. Roles and responsibilities of Hazards Control Department management.

Role	Positions	Responsibilities
Senior Management	Department Head	Provide strategic direction and leadership
	Deputy Department Head	Develop and implement policies and procedures
Leadership Team	Senior Management	Provide leadership, operational management, and
	Division Leaders	supervision of their respective organizations
	Deputy Division Leaders	Develop and implement policies and procedures

Technical Leaders, while having no supervisory responsibilities, work with their respective ES&H team members to ensure that safety policies and guidance are technically sound, compatible with regulations, and consistently applied across the Laboratory. They support personnel within their specific areas of technical expertise, including fire safety, industrial safety, industrial hygiene, health physics, criticality safety, and the H&S Technicians. The Principal Investigators from the SPD and Assistant Chiefs from the EMD are also Technical Leaders.

Standing Committees promote efficiency and effectiveness within the department. Membership is open to all employees and is encouraged by the Leadership Team. The chairpersons and members are employees. A Leadership Team Liaison serves as a committee resource and reports committee activities at weekly Leadership Team meetings (§4.0).

SMWTs are composed of employees who are responsible for a total process relating to a specific product or service. They work as a team, setting their own objectives, taking accountability for monitoring and evaluating their work, and making day-to-day decisions concerning that work. The teams may deal with other departments as well as suppliers and customers.

1.2a(2) Communicating and enforcing values, expectations, and directions. To reinforce employee empowerment, teamwork, customer satisfaction, and ES&H excellence, the Employee Rewards committee was chartered and tasked with developing monetary and non-monetary rewards programs in alignment with the values of the Accident Prevention Program. Committee accomplishments include the redesign of the existing Performance Appraisal process to link salary merit increases to these values. A non-monetary awards program is currently being developed (§4.0).

A card distributed to all employees is an additional reinforcement of employee empowerment and customer satisfaction. This card can be worn on an employee badge. It is a guide and a reminder that employees have the authority to act independently for the good of the customer. It reads:

1. Is it good for my customer?
2. Is it legal and ethical?
3. Is it something I am willing to be accountable for?
4. Is it consistent with the mission of HC?
5. Am I using my time wisely?
6. If so, don't ask permission, you already have it.

1.2b Reviewing company and work unit performance

Performance is reviewed formally and informally by members of the Leadership Team. Some of the information is generated by Technical Leaders and Standing Committees and reviewed by Leadership Team members or Senior Management as appropriate.

1.2b(1) Principal financial and non-financial measures. Financial information is gathered monthly and reviewed by the entire Leadership Team at monthly budget meetings. Operational measures and product/service performance are reviewed monthly by the appropriate Division Leader. Customer and employee satisfaction information is collected by the Customer Standing Committee and reported to the Leadership Team monthly. UC performance measurement data are reviewed monthly by a member of the Leadership Team and reported to Senior Management. (§2.1a).

1.2b(2) Tracking progress relative to plans. Performance is marked against the Strategic Plan goals in the monthly Leadership Team meetings.

1.2b(3) Tracking progress relative to competitors. The other national laboratories operated under the UC-DOE contract (LBNL, LANL), while not strictly competitors, serve as a measure for comparison. HCD progress is measured by comparing the scores of these three laboratories on the contract performance measures evaluated by the DOE each year (Goal 7) and by accident statistics. Informally and periodically, levels and costs of services are compared to outside providers where applicable.

1.2b(4) Determining asset productivity. During the budget process, HCD conducts cost-benefit analyses for proposed vs. existing programs and products, primarily on the basis of risk reduction and associated costs.

1.2b(5) How review findings set priorities. Based on information received, priorities may be adjusted by the Leadership Team through the budgeting process, the strategic planning process, or through other means as appropriate.

1.3   Public responsibility and corporate citizenship

1.3a Integrating public responsibilities into performance improvement efforts

1.3a(1) Risks, regulatory, and other legal requirements. LLNL culture and history emphasize a low-risk work environment, and work practices often transcend the minimum legal requirements imposed upon the Laboratory by literally hundreds of regulations—primarily federal and State regulations, DOE Directives and Orders, and industrial safety standards. As leaders in the ES&H area, this department is expected to promote a safety culture with the optimal feasible protection to workers, the public, and the environment, not merely an adequate or minimum level of safety.

When developing policies on health and safety, HCD factors in the requirements of California OSHA and not just the federal OSHA standards mandated by contract. Because Cal OSHA is generally more stringent, this demonstrates the department commitment to a greater level of safety for workers and others than is required by regulation. Another example is the use of the Cal OSHA asbestos standard in construction projects at the Laboratory. Since LLNL personnel base their work practices on LLNL manuals (e.g., *H&S Manual, RadCon Manual*) instead of just DOE Orders, the department can incorporate the best management practices from industry, the State, and the other UC laboratories and campuses into department ES&H practices.

1.3a(2) How HCD anticipates public concerns and possible impacts. To keep abreast of current issues and future regulatory trends, employees of the department are encouraged by their leaders to be actively involved in the external ES&H community. HCD employees teach occupational health and

safety courses at UC Berkeley and serve on various California OSHA standards review committees. Department technical experts are members or chairpersons of several UC system-wide working groups and task forces, such as those on Ergonomics and Biological Safety. Leaders and employees from the department serve on national standard setting and policy development committees such as the National Fire Protection Association (NFPA), American National Standards Institute (ANSI), Institute of Electronic and Electrical Engineers (IEEE), American Conference of Governmental Industrial Hygienists (ACGIH), and National Committee for Radiation Protection (NCRP).

Public responsibility is an integral part of the way in which HCD conducts operations. In all safety planning and assessments, HCD performs analyses to determine possible impacts to the public and environment, as well as to workers on site. When appropriate, the department participates in public hearings and makes information available at several local repositories. Procedures are also in place to report and mitigate any immediate hazard to the surrounding community or to the general public that could occur as the result of an incident or accident.

The department also participates in local community emergency response planning activities through the EMD, which is viewed as a leader in the fire service community. The EMD voluntarily established mutual and automatic aid agreements with the County of Alameda and City of Livermore, and has first response responsibility for a significant portion of the City of Livermore adjacent to LLNL. EMD is also responsible for dispatching and coordinating mutual aid requests for the County of Alameda, and was very involved in the responses to the 1989 Loma Prieta earthquake and 1991 Oakland Hills fire. They also staff a California Office of Emergency Service (OES) fire engine that is on long-term loan to LLNL, and have dispatched it to wildland fires throughout California and the western United States at the request of the OES.

Off-site emergency response activities other than those provided by EMD include: the DOE Nuclear Emergency Search Team (NEST) contingent based at LLNL and the LLNL Radiological Accident Response Group (ARG) with their "Hotspot" analytical laboratory vehicles. The Hotspot vehicles and trailers, which were developed by the SPD, are designed to provide radiological analysis capabilities under rugged field conditions, and can be transported by aircraft to any spot in the world.

1.3a(3) Promoting legal and ethical conduct. Personnel hired by the department must undergo a background investigation that essentially removes anyone with a history of illegal or unethical conduct from the applicant pool. The department does not condone any illegal activity, and promotes the highest standards of professional and personal conduct.

1.3b Community corporate citizenship

The department and its members are involved in the local community in a variety of ways. Both group and individual contributions of skills, time, and money are encouraged by department leaders. Last year, 102 employees gave $20,200 to local charities and community groups through the department's participation in the Helping Others More Effectively (HOME) campaign at LLNL. Several employees are involved in the "Fun with Science" program, which puts on science demonstrations and programs at local area schools, and in "Expanding Your Horizons," a career day program that introduces young women to careers in technical fields. Other employees are members of the local community college board, and donate their time to local organizations such as the American Red Cross. In addition, the department gives employees time off to address local community groups regarding any health or safety concerns they may have pertaining to Laboratory operations.

The EMD participates in several community programs:

- Learn Not To Burn—a Livermore City Schools program that integrates fire and burn prevention into the curriculum with firefighter participation in the classrooms
- Toys for Tots
- Minority Recruitment Days—firefighters speak at predominantly minority schools about the preparation necessary for a career in the fire service
- City of Livermore Rodeo—firefighters participate in the parade and provide reserve ambulance coverage
- Alicia Ann Rouche Burn Foundation and Camp —firefighters raise funds and serve as counselors.

2.0   Information and Analysis

2.1 Management of information and data

Data analysis of traditional safety statistics, such as reportable injuries, personnel exposures, and fire losses, helps HCD and its clients determine where unacceptable trends are developing or where a particular pattern of risk is present.

Field observations and data analysis give relevant information about customer activities and safety performance. Field observations (e.g., informal facility walk-throughs by technicians, scheduled building inspections by ES&H Team members) of new and ongoing operations often indicate deficiencies or unrecognized needs. Review of project work plans, drafts of new safety procedures, and hazard assessments of potential exposures or building risk classifications also contribute information.

Prior to 1992, HCD maintained data on items common to any corporate safety organization (e.g., number of lost workday injuries, amount of fire loss, number of electrical shocks, and number of reportable injuries). The collection of this type of data became part of the overall business plan with the inclusion of the six 1992 UC-DOE contract performance measures directly related to the HCD department mission (§1.2b). The responsibility for LLNL's performance on these measures created the need for a more formal data gathering and analysis system. Now data are gathered, analyzed, and results reported to the Leadership Team for evaluation. Data necessary for the everyday operation of the department are made available to all by posting it on the HCD server on the Open Labnet network at LLNL and by a variety of other means. An overview of the integration of customer information with technical requirements and budget data is given in Fig. 2.1.1.

2.1a Selection of data

HCD recognizes the importance of data in managing, monitoring, and controlling department operations. The selection of appropriate data is a continuous challenge to the Leadership Team and the Standing Committees.

The data collected from individuals, teams, divisions, and committees in HCD, and information obtained from other organizations within LLNL support the Strategic Plan, the UC-DOE performance measures, and budgetary guidelines. The Leadership Team evaluates and determines how to use the data to achieve the goals of the department and to satisfy the three key business drivers: ES&H excellence, customer satisfaction, and effective team work. After evaluation, key data components are made available to all HCD personnel and customers through the interactions described in §3.1a(1) and §3.2a.

Customer focus is a key component in the selection process. Data must provide information about customers and how well HCD is meeting customer expectations and desires. Teams "live with the customer" and provide real-time feedback to HCD about performance. Customers have direct input to HCD management through daily communication with designated team representatives. The Customer Standing Committee develops ongoing mechanisms of customer feedback and also helps
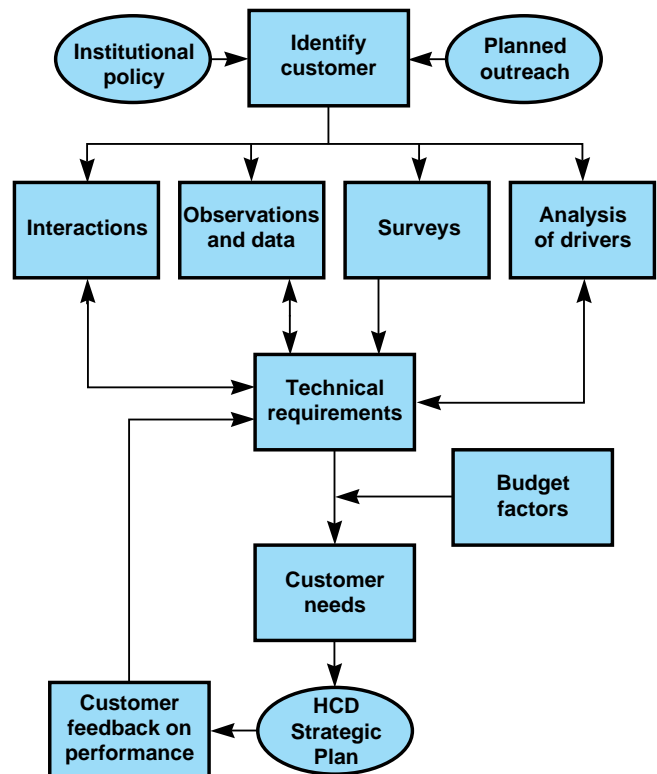
Figure 2.1.1. Process of analysis of customer information and needs (*cf* Section 7).

judge how well technical support and service attain the department purpose—a working environment where every LLNL person has the means, ability, and desire to work safely.

2.1a(1) Types of data collected. Customer requirements and the desire to reduce risk drive the department's work and determine the data collected; the main categories and types of information are shown in Table 2.1.1 with associated key business drivers and related strategic plan goals, which are described in detail in §3.1b.

Table 2.1.1. Key drivers, goals, and the metric data collected to evaluate them.

Data	Key business drivers[a]	Strategic goals[b]	Section reference
Product and service performance			
Ergonomic injury severity	E	2	6.1.2
Person-rem dose	E	7	6.1.5
Electrical shocks at LLNL	E	2	6.1.4
Lost and restricted work days	E	2	6.1.1
Ergonomic injury frequency	E	2	6.1.3
Individual worker dose vs. ALARA guidelines	E	7	6.1.6
Operational measures			
Accuracy and reproducibility measures	E,C	3,6	6.2.4
Laboratory sample turnaround time	C	3,6	6.2.3
Fire Department response time	E	10	6.2.1
Use of computer-based training	C	9	6.2.2
Instrument calibration status	E,C	6	6.2.5
Financial operations			
Fire Department cost /value protected	E,C	10	6.2.8
Cost savings	C	6	6.2.6
Institutional funding	C	6	6.2.7
Special projects funding	E,C	5	6.2.9
Employee satisfaction			
Job Satisfaction	T	11,13	6.3.1
Employees participating on teams	T	11,12,13	
Participation in mentoring program	T	9,11,12,13	6.3.2
HCD employee injury rate	E	2,7	6.3.3
Customer related data			
Level of customer satisfaction	C	4–10	7.4.1
Quality of safety guidance provided	C	1, 4–10	7.4.2
Customer support to field teams	C	4–10	7.4.3
Scores on performance measures	E,C	4–10	7.4.4

[a]E= ES&H Excellence. C=Customer Satisfaction. T=Working as an Effective Team.

[b]Goals are listed in Table 3.1.1.

The injury/accident rate provides a measure of the success of the Accident Prevention Program (Goal 1). To provide data about the satisfaction of Goal 2, which is to reduce risk and promote work-place safety, HCD collects product and service performance indices about ergonomic injury (severity and frequency), electrical shocks at LLNL, and lost and restricted workdays. The Leadership Team reviews injury statistics and the information distributed throughout the department in *Lessons Learned*, a program to communicate accident prevention. Monthly reports from each team and division provide data on current activities, trends, and ES&H needs.

For Goal 3, which is to maintain equipment, systems, and facilities to high quality standards and encourage programs to do the same, HCD collects data on the accuracy of samples and instrument calibration status. For Goals 4–10, which all address customer-related issues, HCD collects information

about timeliness, quality, cost, and customer satisfaction. For Goal 5, which addresses the work of SPD, HCD measures the quality of service provided to customers, and asks what R&D customers want. Measures of institutional funding, cost savings, and operational data on timeliness and accuracy from the laboratories support Goal 6. For Goal 7, HCD determines the consistency, timeliness, and accuracy of the ES&H guidance provided to customers, surveys employee satisfaction, and also gathers product and safety indices (e.g., individual worker radiation dose vs. ALARA guidelines; employee injury rate).

For Goal 9, which is to meet customer and regulatory needs through the HCD training program, the department measures customer and employee participation, gathers information about tailoring and customizing classes for programs and employees, and requests student critiques for training and mentoring programs. For Goal 10, which aligns EMD emergency response goals, objectives, and standards with LLNL's Emergency Preparedness Plan and communicates them to employees and others, HCD collects customer-related, financial, and operational data. Goals 11, 12, and 13 are addressed through customer satisfaction measures, which include team participation, mentoring program, and employee satisfaction indices. An internal survey of HCD employees in 1995 asked "how often have you been satisfied with your job?" Fifty-eight percent said that they were frequently satisfied with their job or satisfied with their job all the time. Only 16% said that they were satisfied with their job infrequently or not at all (Fig. 6.3.1).

2.1a(2) How the measurement system aligns operations with priorities. As discussed in 2.1.a(1), the data collected are in direct correspondence with key business drivers and Strategic Plan goals, and thus are directly linked to priorities established for the department. These data are evaluated by the Leadership Team and priorities adjusted as necessary. Prioritization of data is also guided by the ES&H Working Group Self Appraisal (§7.1a(2)) and the DOE Evaluation of Contract Performance, both measures of customer satisfaction.

2.1a(3) Reliability, rapid access, rapid update. HCD understands the importance of accurate data, which are gathered, tracked, and verified. The department has systems like the EMD Computer-aided Dispatch System (CAD), which automatically tracks and records data on emergency responses and preserves data integrity. The Management Information System Team (MIST) developed a computer-based sample tracking system that uses barcodes to capture individual laboratory sample characterization and identification. The analytical laboratory transfers information from MIST to the sample tracking database. Most analytical results (95%) are directly transferred from the analytical instruments to the laboratory information management system (LIMS) computer and processed automatically. The remaining 5% are processed manually. Results are approved and released in minutes, which gives both analyst and customer rapid online access to the analytical report. Customers also receive an immediate e-mail copy followed by a paper copy of the report.

The Calibrations and Standards Laboratory (CSL), one of the eight Safety Labs, uses an electronic property management system to track the calibration and maintenance of radiation detection instruments. Reminders sent to customers about deadlines for equipment calibration and maintenance decreased the number of overdue and almost overdue calibrations, making a positive contribution to the department's H&S mission (§6.2.5).

As much information as possible is made available to as many employees as possible using manual distribution as well as electronic. Employee input to the Leadership Team is submitted on an electronic questionnaire or a paper form designed by the Communications Committee. This committee also publishes a monthly newsletter, the *HCD Bulletin,* which contains department and laboratory-wide information for employees. When a questionnaire is received, it is placed into a computer system that documents and tracks which member of the Leadership Team is responsible for responding to the employee and documents when the response is provided (2-week limit). Responses are provided individually or in the *HCD Bulletin*.

Data are reviewed by the responsible organization to ensure that they are accurate, trackable, and verifiable. The results are reviewed and evaluated by Standing Committees, the appropriate lab, teams, groups, or the Leadership Team. Data are generated, retained, and validated by the responsible organization, and then posted on several file servers on the Open Labnet network and on World Wide Web Home Pages (§7.2a). Over 95% of Hazards Control employees and most customers can access this

information from their personal computers. Posted data are updated weekly. Although there are no backup copies of server files, the original sources are kept per standard industry practice. Specific legal records, such as emergency response data, incident reports, and emergency medical reports are retained on redundant computer systems and backed-up to tape nightly. The specific information contained in these records is secured against unauthorized intrusion via a specialized security system and documented entry records.

Procedure manuals for the Safety Labs describe systematic approaches for testing and calibrating equipment and how to monitor solutions, equipment, and results (§6.0). HCD is also reducing the time it takes to collect, summarize, and disseminate reports provided to customers (§2.3). For example, Analytical Laboratory customers were asked what they wanted on their reports, and analytical reports were constructed accordingly.

2.1b Improvement of the data system

Hazards Control is well aware of the value of a good data management system. The Standing Committees and Leadership Team are constantly looking for means and methods to improve the quality of data gathered and the system used to collect it through a series of reviews and other methods.

Although data are reviewed on a continuous basis by the Leadership Team, the Strategic Plan includes a detailed annual review. The Leadership Team meets weekly to deal with routine items and holds a monthly off-site meeting to review overall performance. Based on these reviews, the Leadership Team evaluates the usefulness, appropriateness, and value of key data, and specific action items may be developed to adjust data collection, review, and display.

Data are reviewed and evaluated by the originating organizational unit (i.e., division, SMWT, etc.) The various organizational elements of HCD are asked to evaluate data on a continuous basis for validity, usefulness, and value. This information is evaluated and improvements made by the appropriate division, SMWT, Standing Committee, or the Leadership Team. Customers views are sought via formal briefings or informal discussions (e.g., routine reviews by the ES&H Working Group). Feedback received from data users is used to validate the data or change the data process as appropriate.

Following are two examples of the results of the data review process: LIMS reports and instrument calibration control. LIMS improved the quality, accuracy, and timeliness of reports to the Analytical Laboratory customers (§2.1a(3)). Before implementing LIMS and its analytical instrument interface, sample information was kept in several places and data were entered manually. In the old system, everything was first captured manually and then entered into a PC database by data entry personnel: analytical request forms, analysts worksheet, data calculation and reduction, analytical results, and analytical reports. Quality control (QC) results were obtained and entered into the PC database system in a similar way.

The CSL SMWT tracks and maintains calibration histories on portable radiation safety instruments. The team did have a manual system but now uses a barcode laser scanner, e-mail, and a laser printer to track current status, including location, calibration, owner, and detector configuration. The SMWT also tracks service history, including repairs done, calibration dates, and service technicians.

An e-mail report produced by CSL now notifies customers when equipment is almost overdue for calibration. The query that generates this report asks for all instruments that are within one month of needing calibration. Figure 6.2.5 shows that the total of overdue equipment dropped from over 100 instruments to below 50 when e-mail notification was initiated.

2.2 Competitive comparisons and benchmarking

2.2a Data and information selection for comparisons

Hazards Control does not currently have a formal benchmarking plan. Comparative studies have been performed vs. the LANL Environmental Safety and Health Division and LBNL. The department also participated in a research facilities benchmarking conference in October 1995. Expenditures on safety, reportable rate of injuries, radiation exposure, and reportable electrical shocks were examined.

HCD worked with LBNL and LANL to compare ideas for outsourcing, downsizing, or eliminating services.

2.2a(1) Needs and priority determination. The HCD Strategic Plan identifies and prioritizes areas of emphasis in concert with the three key business drivers. The Leadership Team determines those priorities in response to customer requirements and desires. Comparative studies in response to the priorities of the Strategic Plan are informal, using measurements common to the safety and fire protection community. Examples are the annual comparison of fire protection costs to other DOE locations and to the cost of insurance, and the annual comparison of injury and severity of injury statistics to other DOE locations and to Department of Labor statistics. Safety Laboratory analysis capabilities and turnaround time have been compared with those of other LLNL laboratories and San Francisco Bay area companies.

2.2a(2) Criteria for information. It is important that the information gathered be commonly available and commonly gathered by other similar organizations. Because of the need to understand the data comparisons, the information collected comes, in general, from common measures accepted throughout the safety and fire protection community. In addition, by comparing the data on a national basis as well as on a national laboratory basis, the information is not only comparable to industry in general, but targeted to unique situations similar to those present at LLNL. Data collected are linked to HCD's key business drivers as shown in Table 2.1.1.

2.2a(3) How data are used. The data gathered via informal benchmarking assist in evaluating department performance and business practices. This information also serves as a measure of comparison for financial decisions and budgeting allocations. If appropriate, the information is made available to the organizational elements of HCD and its employees, and it is also shared with customers through formal or informal briefings.

2.2a(4) Stretch targets. Information and data are used by the Leadership Team at their off-site meetings to set goals, objectives, and targets. One such target is to provide the best ES&H of any laboratory in the DOE system, as ranked by UC-DOE performance measures. This means exceeding the 90th percentile in all measures related to ES&H excellence.

2.2b How the process is improved

Although comparative studies currently underway have proven satisfactory, HCD is beginning a process that will result in a formal benchmarking plan. This plan will provide the necessary information in a formal way, but be flexible enough to allow the gathering of new data as needs arise. Then the Leadership Team will set the formal plan in motion after consultation with all customer levels. Training in benchmarking techniques and the introduction of benchmarking concepts in department elements has begun.

2.3 Analysis and use of company-level data

2.3a Data analysis, integration, review, and use

Data selection and integration is done at the Standing Committee and Leadership Team level, and gathered, reviewed, and validated at the level of origin. Analysis and evaluation are done by the Leadership Team with feedback to the Standing Committees, organizational elements, employees, and customers.

The data are used to measure progress in meeting the Strategic Plan. In some cases, data are used simply to report progress or to prove a performance measure. In other cases, the data are employed in decision making for changes in direction, implementation of a new program, or resource deployment.

Information and data obtained from the field teams, MIST, and customers of the Safety Labs provide the impetus for a more timely and accurate data transfer system (§5.3a).

2.3a(1) Understanding customers and markets. The Customer Standing Committee surveys program and field customers and presents the data to all employees at all-hands meetings, and also makes the data available on the department fileserver. Then the Leadership Team analyzes those survey results, and merges them with the requirements of the Institutional Customer, as defined in the

UC-DOE contract performance measures. After evaluating the relative importance based on safety and health risk, mandatory regulations, and cost, HCD arrives at a complete picture of the requirements, needs, and desires of its customers. Figure 2.1.1 is an overview of this evaluative process.

In addition, surveys are conducted with employees to measure their satisfaction with the process and goals of the organization. As always, the Strategic Plan provides the road map for departmental activity. Changes in customer needs or desires will result in commensurate changes in the Strategic Plan.

2.3a(2) Operational performance and capabilities. There are several key measures of operational performance, including the UC-DOE contract performance measures, that are a self-assessment of how the department is meeting customer requirements. Independent evaluations of those measures are performed by the ES&H Working Group and DOE. The data for the HCD self-assessment are key to any strategic changes in programs needed to meet the performance requirement. The ability to gather this data and make the self-assessments resides in the various organizational elements of the department. Data are gathered as needed to make these evaluations and the information forwarded to the Leadership Team for final determination.

2.3a(3) Competitive performance. HCD has routinely, as part of the financial plan and budgeting process, compared capabilities and associated costs with other similar service providers (e.g., similar corporate organizations and private providers). Those evaluations have resulted in changes in direction, processes, or priorities (e.g., cost per sample for the Analytical Laboratory). This process will benefit from the more structured benchmarking process outlined in §2.2b.

2.3b Relating performance changes to financial changes

The Strategic Plan goals provide a ready measure of departmental performance. Those measures are then compared against financial changes or budget scenarios. The Strategic Plan provides the means for evaluating performance changes vs. financial changes. Goals 4 and 6 of the Strategic Plan deal with providing "efficient and economical service." These evaluations are made on a routine basis, but not less than annually during the Strategic Plan review process. HCD is maintaining performance in spite of declining overall budgets (§7.4). When surveyed, most customers responded that they had noticed no decline in service.

3.0   Strategic Planning

3.1 Strategy development

Formal strategic planning was introduced to the department in 1993. Since that time, the Leadership Team has held monthly meetings to discuss customer services, quality, and other organizational issues, and to make appropriate changes in strategic plans and direction.

The HCD Strategic Plan is a living document. Changes and future direction in planning are accommodated as needs and situations dictate. When issues are identified, they are discussed at either weekly or monthly off-site Leadership Team meetings, and may be referred to the appropriate standing committee for comment. When a final decision is reached, a goal that addresses the issue and one or more indicators of progress in its attainment are incorporated into the department's formal Strategic Plan.

In 1994, employees were asked what HCD would be like if all department visions were fulfilled. Over 250 employee statements were subjected to situational analysis. The analytical results and information from customer and employee surveys, drivers/constraints, and critical issues were used to develop the three key business drivers that form the basis for the strategic plans. These three key drivers are:

- Promote ES&H excellence
- Achieve customer satisfaction
- Perform as an effective team.

3.1a(1) Customer requirements and expectations. While interviews and surveys have a profound effect on the planning process, customer needs and future plans also come from several other interactions. Customer requirements are discussed more fully in §7.1.

3.1a(2) Competitive environment. In areas where the research is classified, the associated ES&H activities cannot be outsourced. In other areas, the department conducted extensive investigations of outsourcing, particularly for the Safety Laboratories and the EMD. These have consistently demonstrated either higher cost, or, at similar cost, the inability of outside contractors to provide the special services required at LLNL. Safety analysis documentation by outside contractors has been less desirable than department-managed documentation efforts because of the lack of contractor familiarity with LLNL and the DOE community.

The capability to meet DOE standards and best management practices has clearly been the deciding factor in selecting HCD to supply technical support to line management in the preparation of safety basis documentation for all LLNL facilities, Safety Laboratory services (especially emergency services), and Emergency Management services.

3.1a(3) Risks: financial, market, technological, and societal. Risks were included as part of the situational analysis in the 1994 and 1995 Strategic Plans. They were derived from the constraints and drivers identified earlier, from the general experience of HCD personnel, and from customer surveys that were subjected to a complete situational analysis.

HCD monitors the overall DOE budget for the Laboratory and the budgets of individual research and operating programs. These indicate large program trends, the DOE money available for H&S R&D, and pressure on the Laboratory to redefine its mission. These factors affect the range and extent of services that HCD is expected to provide. The end of the cold war caused a shift in emphasis and dollars from nuclear testing to stockpile stewardship. It is incumbent on HCD to adapt to these major shifts by preparing a flexible team mix to address newly emerging H&S issues. The HCD presentations to the Director's Cost Cutting Initiative (CCI) exemplify the pressure to manage expenditures carefully in order to provide maximum service at the same or reduced cost. HCD's budget planning process (Goal 2) was developed to respond to the changing circumstances encountered in recent years.

Individual client budgets and their impact on HCD allocations are discussed by the affected Team Leader, SPD principal investigator (PI), and/or the HCD resource managers.

3.1a(4) Department capabilities. Strategic Goal 7, which is to provide consistent, accurate, and timely ES&H guidance to customers, means that HCD brings its department vision into each program and customer location. HCD participates in the planning and execution of existing and new customer experiments and in the design, construction, and maintenance of customer equipment and facilities.

Because HCD's primary product is advice and consultation in ES&H matters, hiring competent personnel and then providing opportunities for them to increase their skills and knowledge is crucially important to success (§4.0). The training HCD offers to customer organizations is probably of equal importance.

An example of the department research and development (R&D) capability, SPD provides "just-in-time" safety R&D for LLNL programs (e.g., HEPA filter studies and flammability studies of solvent/explosives mixtures in support of nuclear weapons disassembly work). Key issues for the SPD are delivering high quality work and maintaining an adequate technical staff to support LLNL programs.

3.1a(5) Supplier and/or partner capabilities. The department purchases safety glasses, safety shoes, respirators, and first-aid training via blanket orders established through a competitive bidding process to minimum LLNL performance specifications. HCD suppliers sometimes become product developers; for example, eye protection for the harmonic frequencies of the Nova laser system required development of a specific laser eyewear.

The department works with the other ES&H departments—Environmental Protection (EPD) and Health Services (HSD)—to provide an improved one-stop ES&H service for joint customers. These action items are part of Strategic Goal 4.

In keeping with the HCD vision, members of the department form an integral part of each customer program; these employees participate in the planning and execution of existing and new experiments and in the design, construction, and maintenance of customer equipment and facilities. ES&H Team 3 works closely with the Weapons Program to disassemble and retrofit nuclear devices in Pantex. In recognition, the DOE gave the department an "Award of Excellence for the Significant Contribution" to the "Crack W48 Clean Up Team." The EMD has partnerships with other fire departments located near LLNL (§1.3).

Department staff has also established partnerships with other agencies on the following programs: Radiation Assist Program, NEST, and the ARG. As part of Nuclear Non-Proliferation, the department also works with external partners to develop a Mobile Radiation Measurement Laboratory for nuclear disarmament in the Former Soviet Republic of Belarus.

The Health Physics Training (HPT) team has a memorandum of understanding with local hospitals to train hospital staff to handle injured personnel who may have been contaminated with radioactive materials. In the event of an accident involving radiation, LLNL employees can be sent to these hospitals with the knowledge that the medical staff is appropriately trained.

Advances in computer-based training (CBT) and Web-based training (WBT) are dependent on advice and information received from TRADE and from individuals within and outside LLNL. This information guides purchases of computer equipment, commercial training software, and information management software that put HCD's CBT/WBT efforts in the forefront of the DOE community's progress in this new technology. The Education, Training, and Safety Analysis (ET&SA) Group and the Safety Labs Division are also discussing the possibility of partnering with sister DOE Laboratories to share resources in areas of training and dosimetry.

3.1b   Strategy translation into actionable plans

Strategic goals derived from the key business drivers (Table 3.1.1) form the basis for effectively improving each area of the business in concrete ways. Every strategic goal is assigned to a division, group, or team leader, who develops intermediate and longer range implementation plans for review by the entire Leadership Team. Once each month, one-third of these goals are reviewed, including actions already implemented and future action items. Thus, every quarter, the entire strategic plan and its implementation are subjected to a systematic review.

The 1994 Strategic Plan had many goals that were internally oriented to help employees become more comfortable with the department reorganization and to make the department an example of the Accident Prevention Plan in action. In December 1995, the Leadership Team revised the Strategic Plan to reflect external goals related to customer surveys, performance measures, and accident prevention on a laboratory-wide basis.

Table 3.1.1. Goals from the 1995 Strategic Plan by key business driver

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Promote ES&H Excellence

Goal 1   HCD will clearly define and communicate the Accident Prevention Program for LLNL so every employee will understand its importance

Goal 2   HCD will focus its resources to reduce risk and promote workplace safety

Goal 3   HCD will function as a leader in APP by striving to maintain its equipment/systems and facilities to high quality standards and encouraging programs to do the same

Achieve Customer Satisfaction

Goal 4   HCD will foster a cooperative relationship with EPD, PE, and HSD such that together we will provide our customers with efficient and effective service through the ES&H teams.

Goal 5   HCD Special Projects Division will provide high quality service to our customers, both inside and outside the Laboratory.

Goal 6   HCD Safety Laboratories will provide timely, high quality, and cost competitive services

Goal 7   HCD will provide consistent, accurate, and timely ES&H guidance to our customers

Goal 8   HCD TS&PD Division will improve the usefulness of the Health and Safety Manual.

Goal 9   HCD will ensure its training program meets customer and regulatory needs

Goal 10   EMD will ensure that its Emergency Response Goals, Objectives, and Standard Outcomes are consistent with the Laboratory Emergency Preparedness Plan and that these goals, objectives, and standard outcomes are adequately communicated to HC employees, LEDOs, Assurance Managers, Team Leaders, and appropriate Program Representatives.

Perform as an Effective Team

Goal 11   All employees participate in Department efforts in accomplishing our mission and enjoy opportunities to excel.

Goal 12   We will encourage open communication with and between elements of the Hazards Control Department.

Goal 13   We work in an atmosphere of empowerment, accountability, teamwork and problem solving.

3.1c Evaluation and improvement of planning processes

The department learned several lessons in developing the first Strategic Plan. First, limit the number of goals and objectives in the plan to a number that can be readily understood and assimilated by employees. One of the chief complaints from informal employee interviews was that the plan was too big, and employees could not readily determine how the plan related to their job functions. Second, clearly delineate top priority objectives from those with medium priority and those that are ongoing in nature. This helps employees set priorities for their own activities and goals. Third, some member of the Leadership Team should be held accountable for the results of goals and objectives to assure progress. Quarterly reviews of goal status are also useful. Last, make goals and objectives a meaningful part of an employee's job. Employee comments continued to be solicited on the draft plan before it was accepted.

Several other changes were made to the planning process:

- Employees were kept informed about the status of the Strategic Plan at all-hands meetings
- Standing committees determined how they could support the goals and objectives of the Strategic Plan
- Two divisions specifically incorporated Strategic Plan goals as part of their employee performance appraisal goals, a strategy that will be duplicated in other divisions of the department for the current plan.

The Leadership Team put these lessons to good use in developing the 1995 Plan. It took almost a year to develop and fine tune the 1994 Strategic Plan but the 1995 plan was developed in less than two months. Another improvement for inclusion in future plans is benchmarking to implement stretch goals.

3.2 Strategy deployment

3.2a How key drivers are translated into actions

3.2a(1) Deployment of key performance requirements and measures. The ultimate measures of department effectiveness are the OSHA-reportable injury/illness rates, employee exposure data, and the rate of potentially serious accidents. The first two measures are well-defined but the third is less so. Judgments must be made as to the potential for serious injury and non-injury accidents may not be properly reported. Still, the Accident Prevention Program seeks to promote an attitude of safety among all LLNL personnel. This attitude does not tolerate unplanned activities that could lead to accidents. This is the heart of excellence, the first key driver in the health and safety program.

The second key business driver, customer satisfaction, requires that the department achieve excellence without diverting labor and funds from line management goals and concerns. Teamwork, the third key driver, is the process by which HCD believes the first two key business drivers can be achieved.

Figure 3.2.1 illustrates how the key business drivers are translated into specific actions to improve department performance. First, the department derives goals to meet the key business driver. Next, specific measurable objectives and measurement tools are identified. Then the objectives are prioritized and metrics obtained from injury, accident, and chemical/radiation exposure records; customer and employee survey results; and training records, field team records, and emergency management records. Measures of success include UC performance measures, strategic plan goals, and/or target/trend data from different divisions of the department.
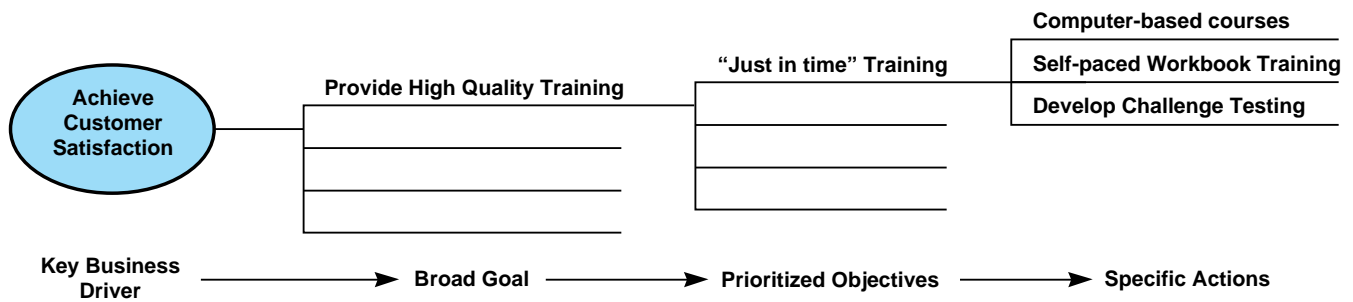
Figure 3.2.1. How a key business driver (customer satisfaction) is translated into specific actions.

3.2a(2) Alignment of work unit and supplier/partner plans and targets. Teamwork is the informal mechanism HCD uses to align department plans and objectives with those of customers, vendors, and other members of internal and external partnerships.

The use of field teams working directly with customers ensures that customers and partners are represented in the HCD strategic planning process and in the development of performance objectives by:

- Understanding their needs
- Accommodating their programmatic schedules through just-in-time training and just-in-time Facility Safety Procedures (FSPs) and Operational Safety Procedures (OSPs)
- Responding rapidly to concerns in the field with H&S technical advice
- Implementing cooperative corrective action when accidents do occur.

In response to implementation of the Strategic Plan, the department has partnered with HSD and EPD by adding a representative from HSD and EPD to each ES&H field team. The EPD representative attends weekly HCD Leadership Team meetings, and ES&H Team Leaders participate in bimonthly meetings with EPD and Plant Engineering personnel to resolve issues involving all three ES&H departments. This improves customer service and provides additional feedback to the Strategic Plan.

3.2a(3) Productivity, waste, and cycle time improvements. The Team Work and Customer Satisfaction key drivers spurred the adoption of several objectives in the Strategic Plan related to efficiency and response time with corresponding improvements in training, documentation, and emergency response. The 1995 Strategic Goals and Objectives related to productivity and cycle time improvement include Goal 9 (time from when a request for training is submitted to the time the person receives training), Goal 7 (the time to process OSPs), Goal 8 (time needed to make changes/corrections to the *H&S Manual*), and Goal 7 (design review turnaround time).

CBT and WBT are expected to reduce the waiting time for required training. CBT classes are scheduled within one or two weeks of receiving the request. WBT will be available whenever the LLNL employee has access to an Internet connection. These self-paced classes tend to improve retention, and WBT material is also available at any time for reference.

Internet connections are a valuable resource for other reference materials that this department is chartered to provide. For example, the *H&S Manual* is accessible from the LLNL Home Page, which makes any changes in LLNL policy available as soon as updates occur. This electronic version eliminates the need for controlled copies, which involve tracking where updates should be sent. The review cycle was shortened, improving timeliness, and the $2.8 million cost of the controlled hard copy system was averted.

EMD response time to a single emergency at Livermore is less than 2 minutes. In addition, emergency personnel are now trained to full paramedic status so actual medical treatment begins much sooner. At least four lives have been saved that would previously have been lost.

ES&H Teams have shortened the time allowed to review OSPs and Design Packages. Material once located in OSPs has been shifted to FSPs, which require only triennial review.

Department waste reduction efforts and the associated savings include: negotiating guidance status for the *RadCon Manual (*$2 million/year), reducing the safety basis documentation requirement to

Preliminary Hazard Analyses for low-hazard facilities (est. $1.2 million/year), eliminating sprinkler systems to plenum space under computer room floors (at least $200,000), and four hours of training time every three years for personnel who maintain first aid certification.

3.2a(4) Resources to accomplish short- and long-term plans. Budgeting is an iterative group process performed by the Leadership Team. HCD has addressed several budget cut scenarios, including 5, 10, and 20% cuts. Although these are usually highly emotional, the Work Breakdown System developed by HCD lends an element of objectivity. This system defines a group of Work Budget Elements (WBEs) where each element is made up of a group of tasks called a Function. Each Function is a self-contained set of manpower, supplies, and equipment that could operate independently or as a mini-cost center. If there are further budget cuts, the department can eliminate a WBE or WBE Function and the remaining WBEs would not be adversely affected.

Each activity in the department is prioritized by risk and then funded accordingly. Objectives identified as Priority A in the Strategic Plan are generally fully funded.

1. Establish risk-based priorities (continuing successful programs, upgrades or improvements to existing programs, and promising new programs for new or more efficient services)

2. Make a zero-based budget according to the following criteria:

    Core programs (protecting people) that reduce real ES&H risks or remediate ES&H impacts directly related to LLNL activities

    Federal, State, and local regulatory requirements

    DOE Orders, Directives, and compliance with Contract W-7405-ENG-48.

Staffing levels are determined as part of this process. For instance, EMD proposed a reduction in the size of a firefighting company under certain conditions for FY96 (Table 6.2.6). This was approved and will lead to a small reduction in force (by attrition) with annual cost savings of $283,000. On the other hand, extra office time to deal with the vision requirements of an aging work force for the Safety Glasses Office was not funded because it did not successfully compete against existing safety programs.

3.2b Two-to-five year future projections

Departmental planning must always be flexible. Two years ago, a projection of the future for the department might have suggested that the loss of weapons programs from LLNL would result in a reduction of the need for radiation control training and for health physics support in general. Today, the Weapons Program is once again a major long-term effort at LLNL, focusing on disassembly operations in support of national nuclear weapons reduction. For the foreseeable future, HCD must maintain a strong core field program in each of the H&S disciplines. The department must also maintain a core of personnel to monitor the effects of possible shifts in oversight requirements. Proposals currently under consideration would change the requirements from:

*   Strict compliance with all DOE Orders and Rules to "necessary and sufficient"

*   DOE Environmental Health (EH) oversight to NRC or Defense Nuclear Facility Safety Board (DNFSB)

*   DOE requirements to OSHA.

LLNL is currently completing a CCI study to identify ways to reduce the costs of overhead support and allocate more funding to R&D. The future of HCD funding in light of this study is uncertain. Hazards Control has sustained cuts over the past four years and, as described in external Peer Review and internal Director's Review, must improve its operations if it is to avoid loss of critical functions in future funding cuts. Methods of absorbing future cuts include: further reorganization and reduction of management staff; exchange of materials, manpower, resources, and ideas with sister laboratories; and more outsourcing to reduce full time staff positions. The department has agreed to benchmark DOE and private R&D laboratories to investigate any cost saving strategies currently in use in these facilities, and determine which best apply to HCD operations.

4.0   Human Resource Development and Management

Because HCD's primary product is technical advice and consultation on ES&H matters, human resources are of critical importance to success. The department hires competent personnel and provides training, mentoring, and guidance to improve employee skill levels. Continuing and advanced education and certification at professional and technician levels are encouraged and financially supported. Top department staff members are nationally and internationally recognized experts in their fields. They win national awards, serve on national committees—often in leadership positions—and review documents produced by DOE and other national organizations. In turn, these staff members train and guide others in the department. As a result, HCD personnel are knowledgeable in technical and legal aspects of their particular fields and are cognizant of new rules and orders that will affect the Laboratory in the future. This level of competence and professionalism extends to HCD field technologists. They are trained and educated in broad health and safety areas, and can often answer technical questions from customers that would normally be handled by professional level staff in many organizations.

4.1 Human Resource planning and evaluation

Human Resource (HR) planning and evaluation is integrated into the business and strategic plans of the HC department. Four HCD Strategic Plan goals and 17 objectives address HR planning and evaluation. They are linked to the HR planning process as shown in Table 4.1.1.

To ensure the training program meets employee, customer, and regulatory needs (Goal 9), HCD will:

- Add questions on training to internal and external customer surveys
- Provide "just-in-time" training
- Complete the training matrix and individual training plans
- Identify retraining requirements and automate notification to employees and supervisors when retraining is required.

Table 4.1.1. Linkage of strategic plan goals and objectives to HR planning.

HR Goals	HR Objectives
#9. HCD will ensure its Training Program meets customer and regulatory needs	1. Add questions on training to internal and external customer surveys 2. Provide just-in-time training 3. Complete the training matrix and individual training plans 4. Identify retraining requirements and automate the notification process when retraining is required for employees and supervisors
#11. All employees participate in departmental efforts accomplishing our mission and enjoy additional opportunities to excel	1. Communicate the Strategic Plan to all employees at quarterly all-hands meetings; continue to ask for feedback from all employees 2. Develop a new rewards system to encourage all employees to work as an effective team 3. Avoid the "halo" effect by circulating assignment opportunities to all employees 4. Accept more employee input of ideas and suggestions to the Leadership Team
#12. We will encourage open communication within and between elements of the Hazards Control Department	1. Department Head will conduct 2-on-2 meetings in the field 2. Continue to use the Communications Committee 3. Continue conducting quarterly all-hands meetings 4. Conduct upward evaluation of all Leadership Team members 5. Institute an open door policy for all division/team/group meetings 6. Conduct departmental/division/team social functions to foster employee interaction and communication
#13. We work in an atmosphere of empowerment, accountability, team work, and problem solving	1. Have the Leadership Team serve as the example 2. Continue to develop and explore the option of SMWTs 3. Use TQM/CQI techniques for problem solving, team work, and process improvement

The department's standing committees give employees an opportunity to participate in department decisions and help them develop new skills. Each of these committees plays some role in HR:

- Customer Committee (§4.4c)—Tasked with developing an ongoing mechanism of customer feedback to judge how well HCD's technical support and services help customers achieve a working environment where every LLNL employee has the means, ability, and desire to work safely. A similar ongoing mechanism was developed and implemented to obtain feedback from HCD employees.
- Rewards Committee (§4.1a(3))—Tasked with developing a rewards system in alignment with the mission, vision, purpose, and core beliefs of HCD. This committee is composed of representatives from all job classifications in the department (Administrative, Engineer, Scientist, Technician, etc.).
- Skills, Knowledge, and Abilities Committee (§4.1a(2))—Identifies and defines the qualities required of employees in HCD. These must be in alignment with the purpose, mission, vision, and core values/beliefs of the department.
- Communication Committee (§4.2a)—Tasked with developing efficient and effective communications. An example is monthly publication of the *HC Bulletin*, which is also being installed on the Internet Home Page.

In addition to HR activities that take place in the standing committees, the Hazards Control Work Force Diversity Working Group initiated the Mentoring Program (§4.3a).

4.1a(1) Changes in work design. HCD made the changes in work design that support the objectives of Strategic Goal 13 listed in Table 4.1.1. The department also reduced the layers of management, re-engineered the ES&H Teams, and initiated the development of SMWTs (§4.2a).

4.1a(2) Employee development. Key elements of HR planning for employee development include:

- Training Plan and training matrix for each individual employee (§4.3a)
- Training for SMWTs (§4.3a)
- Mentoring Program, which encourages employee development (§4.3a)
- The four standing committees.

The SKA Committee and the Training Group ensured that employees had the knowledge and ability to implement the new HCD strategic plan, with special emphasis on SMWTs.

4.1a(3) Changes in compensation, recognition, and benefits. The Rewards Committee addresses strategic plan changes in compensation and recognition. Key issues are to:

- Develop performance standards for all divisions/groups/teams, including both vertical and horizontal (cross-functional) groups and teams
- Develop a system that emphasizes cooperation and teamwork. Individuals should be rewarded for their contributions to groups, teams, and committees, as well as for their individual accomplishments
- Develop creative ways of rewarding employees (monetary rewards are not adequate). These solutions must also meet the appropriate LLNL policies and employees must buy-in to the system
- Resolve the existing view of ranking as competition between employees and groups. The new ranking system needs to encourage cooperation and teamwork between employees and groups
- Provide appropriate training and education for all leaders to ensure they have the knowledge and skills to implement the new rewards system.

4.1a(4) Recruitment. The department has a Work Force Diversity Working Group and Affirmative Action (AA) Coordinators who ensure that diversity and affirmative action are considered when filling all department positions. The EMD belongs to a consortium of area agencies that maintains a list of qualified candidates. AA and diversity are considered in their recruitment process. The EMD also has a trainee program for firefighters that has been an effective tool for recruiting women and minorities.

Because of uncertainties about the future LLNL mission, HCD is filling open positions with term and supplemental labor, employees who are making a career transition, and career employees from

other LLNL organizations. Projections of future needs and current SKAs give us valuable information for planning and future recruitment.

4.1b Evaluation and improvement of HR plans and practices

The department evaluates and improves its HR planning and practices with employee participation via membership on standing committees, the Diversity Program, Affirmative Action Program, and employee surveys. Feedback for evaluation and improvement is obtained in a variety of ways. Some examples are:

- The Rewards Committee redesigned the department performance appraisal process using input from the Leadership Team and an employee survey. After a year, the process was simplified, again using information from employees and the Leadership Team.

- A year after reorganization, employees were surveyed to identify concerns and issues. The Leadership Team reviewed the results and developed appropriate action items.

- Diversity is considered when forming panels, teams, and committees (e.g., selection panels, standing committees, process action teams, and reclassification boards). Diversity Awareness training is a requirement for all members of the Leadership Team. A department Diversity Library lends videos, articles, and books.

- LLNL has a complaint resolution process. Since 1993, 13 complaints were resolved within HCD. Only one complaint has gone to staff relations for resolution, and no grievances have been filed.

4.2 High-performance work systems

4.2a How work and job design promote high performance

There is only one level of management between employees and the Department Head (§1). The SMWTs and various policies described below (e.g., training, flex hours, and work-at-home) give employees more control, and thus tend to increase job satisfaction and performance. Additional opportunities for initiative and self-managed responsibility arise in meetings of work teams, standing committees, and *ad hoc* groups that are not led by members of management.

Department policy allows flexible work hours, established by agreement between employee and supervisor whenever there is no negative impact on the customer. The department also provides computers, modems, and phone lines to allow employees to work at home.

Eighty employees are divided into 12 SMWTs in the Safety Labs Division, Administrative Services, and ES&H Team 1. The work teams empower employees to make many decisions formerly made by group leaders and provide more opportunity for cross training.

Formerly, all professionals in a discipline (Industrial Hygiene, Health Physics, Fire Protection, Industrial Safety, and Criticality Safety) reported to a group leader and were matrixed to the ES&H Teams. There are no discipline-based groups in the new organization; professionals are directly assigned to teams and are encouraged to cross train in other disciplines, adding flexibility. These changes improve team competence, response times, and flexibility to better accommodate different customer needs and schedules.

Employees in the same discipline meet regularly to standardize their approach and communication with customers. Anyone else in the department with an interest in a particular discipline is encouraged to attend these meetings.

Ad hoc groups consider internal issues that cross division lines (§5). One such group is the Administrative Process Action Team (PAT), made up of associate administrators and administrative specialists who develop and enhance department-wide administrative processes. Another *ad hoc* group is the Software Application Prioritization Committee that provides oversight of software development projects written by programmers from another LLNL department.

4.2b Compensation and recognition

In an earlier performance appraisal process, ranking was done by group and division leaders and was based on job value; performance; and skills, knowledge, and abilities. The Rewards Committee

redesigned the performance appraisal and ranking process within LLNL guidelines to reinforce the values of the new organization. Performance factors now include: output quantity, output quality, teamwork, accountability, people skills, problem solving, and additional contributions. Customers are contacted for input on the performance appraisal; Division Leaders receive upward appraisals. The department encourages employee involvement in publishing and presenting papers; committee membership and leadership at the local, national, and international level; membership and leadership in local, national, or international working groups; editorial activities for refereed journals; participation in emergency responses, drills, and training; Affirmative Action and LLNL outreach programs; department standing committees; the mentoring program; and completion of semester classes at an accredited college or university. Scores received for these additional contributions indicate that many employees are making contributions beyond the maximum expectation.

HCD is organizing responses obtained through interviews and written suggestions from employees to find out what types of non-monetary rewards they believe are appropriate. Using employee input, HCD will present a choice of non-monetary rewards from which employees can select. When the survey is complete, recommendations will go to the Leadership Team for the final decision on what to reward and how and when to present rewards. The committee is sorting rewards by category (e.g., personal, team, no monetary value) and potential cost. One committee member is also summarizing the general suggestions that would improve the quality of life in the department.

The results from a December 1994 survey of employees showed that 67% of respondents had noticed an improvement in teamwork in their immediate work group after reorganization (§6.3.1).

4.3 Employee education, training, and development

4.3a Building department and employee capabilities

Hazards Control encourages both formal and informal training plans to build department capabilities and contribute to employee motivation, progression, and development. Over the last three years, 181 employees participated in the Educational Assistance Program at LLNL, and 32 have completed either a degree or certificate.

Table 4.3.1 shows the participation in activities for which employees receive credit in the new performance appraisal process.

Table 4.3.1. Additional contributions for performance appraisals.

Category	# of employees[a]	employees (%)[a]
Degrees (AA/BS/MS/PhD)	144	75
Working on a degree	45	23
Has a professional certification/ license/registration	80	42
Published papers in 1995	14	7
Presented a paper at a conference in 1995	25	13
Involved in a local/national/international ES&H committee	53	28
Involved in a local/national/international ES&H working group	35	18
On an editorial board for a professional journal	7	4
Member of an off-site emergency response team (NEST/ARG/HOTSPOT)	56	29
Involved in LLNL-supported community outreach program	33	17
Leader of an ES&H professional society	11	6
Member of a department standing committee	86	45
Participant in HCD Mentoring Program	36	19
Chair of an LLNL committee	38	20

[a]192 full-time UC employees (excludes Leadership Team, contract employees, and UC employees matrixed to Hazards Control Department from other LLNL organizations).

A pilot mentoring program was established by the Workforce Diversity Working Group in January 1995 to help employees develop the technical, administrative, and personal work skills needed to

enhance their careers. This program also allows employees to cross train, increasing their flexibility and value to the organization. The pilot included 15 pairs of employees from all classifications, and a follow-up program now includes 26 pairs (§6.3.4).

4.3b Design, delivery, reinforcement, evaluation, and improvement of education and training

The Department Head is responsible for determining the required training for the Leadership Team. Division leaders are responsible for determining the required training for their employees.

The department requires individual training plans for all employees, which are reviewed at least once a year for status and appropriateness. Training recommendations and requirements are included in the plans. Education and training completed are noted in the career development section of the employee performance appraisal. The Educational Assistance Program allows employees to use six hours a week to attend classes. In addition, employees are reimbursed for tuition and fees provided they receive a grade of C or better. Knowledge and skills are reinforced through on-the-job training with senior professionals assigned to train new professionals in the field.

Training is conducted by on-site organizations (e.g., HR, EPD, HCD, and Engineering), colleges and universities, and equipment manufacturers who offer specialized classes. Special attention is also paid to certification programs in areas like Health Physics, Industrial Hygiene, and Safety. The skills and knowledge obtained from CQI training were used in re-engineering the department. HR gave the SMWTs just-in-time training for their new role. HCD's Training and Education Group (§5.1) designs, delivers, evaluates, and improves the technical training they provide to technicians in the Safety Labs and H&S technicians assigned to the field teams.

Job-task analysis, customer surveys, and evaluation forms filled out by students are reviewed and used to improve training classes. New and innovative training methods include CBT, video tapes, and role playing. Data accumulated from performance appraisals also help identify employee skills that require further development.

4.4 Employee well-being and satisfaction

4.4a How the department maintains a safe and healthful work environment

4.4a(1) Factors for employee well-being. The department maintains a healthful and safe environment for its employees through periodic workplace inspections by Safety Teams and self-assessments of the workplace by the Division Leaders and Deputy Division Leaders as specified in the department *Self-Assessment Plan*. Safety deficiencies are tracked in a database that is reviewed by management once a month. A systematic process is used to analyze the causes of accidents, and an OSHA log of accident statistics is provided to the Department Head. Some divisions offer ergonomic work station evaluations; Safety Teams have ergonomic evaluators. In addition, every employee is empowered to stop a work activity if he feels it is unsafe. Safety is further reinforced as a component of accountability in performance appraisals.

4.4a(2) Improvement indicators. A back care program for firefighters was instituted to reduce back injuries in EMD. This program reduced the lost workday injuries to 1.3 lost workdays per person per year from a 7-year average of 2.3.

In 1993, the recordable injuries rate in the department as a whole averaged 1.75 per month. The goal to keep this below 1.25 per month was achieved in both 1994 and 1995 (§ 6.3.3).

EMD significantly improved its level of medical assistance when all firefighters obtained state certification as paramedics (previously, all were Emergency Medical Technicians). During the first six months of the program, the new firefighter/paramedics saved 4 of 5 cardiac arrest victims. Without paramedic capabilities, HCD firefighters had not been able to save anyone in full cardiac arrest before.

In 1995, the department volunteered and funded an employee wellness pilot program for Hazards Control employees in partnership with HSD. One representative from each division served on a health action team to determine the activities and services to be provided at employee work areas (e.g., back care clinic, blood pressure monitoring, and stress management). Education on health issues and a monthly wellness newsletter were included. After the initial one-year pilot, the department sponsors an ongoing wellness maintenance program in partnership with HSD (Table 4.4.1).

Table 4.4.1. LLNL Wellness Program.

Offering	Examples of services	Benefits
Wellness communication and health awareness	Interactive health information center Wellness newsletters	Wellness Communication and Health Awareness products provide immediate information and resources in employee work areas that support healthy lifestyle choices
Screening and assessment activities	Wellness appraisal inventory Cardiovascular fitness assessments Muscular and flexibility assessment Nutritional analysis Body fat assessment Blood pressure screening Stress map screening	Wide array of Wellness screening and assessments helps employees understand current health status, provides feedback on areas of strength and weakness, and directs them to related services for further help
Wellness education programs	Men's and women's self-care education Exercise prescription education Nutrition education Weight management education Stress management education	Wellness Education programs provide in-depth understanding of health topics through participatory classes and hands-on experiences
Intervention programs	Think light for low fat living plan Managing blood pressure Managing cholesterol Smoking cessation	Wellness Intervention programs offer personalized instruction in managing specific health concerns through behavior modification and assessing the effects of treatments
Wellness counseling	Individual counseling for special concerns	Wellness Counseling provides opportunities for one-on-one interaction to discuss individual health needs and concerns

4.4b Services and facilities

LLNL provides a benefits package superior to that of most other organizations in the industry for the support of employee well-being and satisfaction. It includes a (1) credit union, (2) drug/alcohol program, (3) weight control program, (4) stop smoking program, and (5) many noon-time activities (e.g., aerobics classes, volleyball, basketball, quilting, swimming, running, par course, computers, and chess). In addition, the department sponsors summer picnics and holiday parties.

4.4c Employee satisfaction levels

The department determines employee satisfaction, well-being, and motivation by several methods, including: internal surveys, feedback during the performance appraisal, feedback from organizational meetings held on a regular basis, standing committee reports and a question period at all-hands meetings, and from anonymous questions submitted to the Leadership Team (on a form in the *HC Bulletin*).

The Customer Committee survey of employees in December 1994 showed that 58% of the respondents were either frequently or always satisfied with their jobs (§ 6.3.1).

5.0   Process Management

The primary function of HCD is to provide H&S guidance and support to LLNL programs and employees, to protect employees and the public, and to prevent damage to Laboratory property and the environment.

HCD's primary products are information-based, and generally are the result of processes that act upon sources of information and data, including customer requirements. New products, or modifications of old ones, are then used by customers to produce a desired outcome (i.e., a safe working

environment). HCD employs various methods of advising, assisting, and monitoring to help cus-
tomers attain the desired outcome (Fig. 5.0.1). Analysis, reviews, and/or surveys are conducted at the
output of each step in Fig. 5.0.1 to effect the desired outcome and to continually improve the system.
These are explained in the following section.
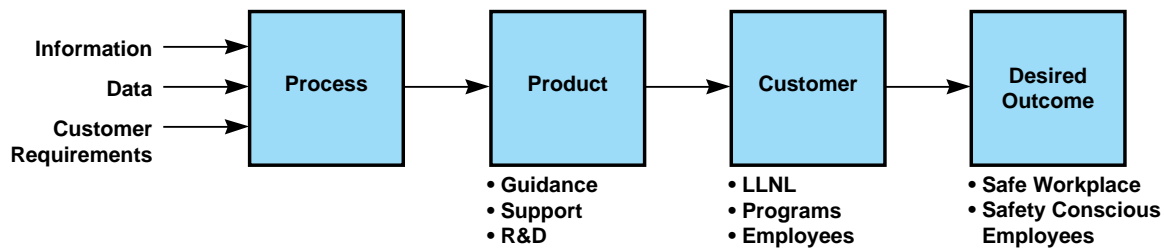
Figure 5.0.1. Process management model used by the Hazards Control Department.

5.1 Design and introduction of products and services

5.1a How products, services, and production/delivery processes are designed

5.1.a(1) Translation of customer requirements. HCD determines the customer's requirements at
an early stage in a number of ways (Fig. 2.1.1; §7.1a(2)). Subject matter experts (e.g., professionals
and technicians in the various safety disciplines of industrial hygiene, health physics, industrial safe-
ty) analyze the requirements to determine internal and external needs. These experts are trained and
qualified to identify and recognize the health and safety aspects of the requirements and the cus-
tomer's operation. They apply their expert knowledge of health and safety rules, regulations, stan-
dards, and LLNL management practices to identify hazards and propose controls necessary to miti-
gate them. They develop procedures that meet performance and quality standards, and arrive at a
design that is best suited to meet the customer's requirements. Support requirements are identified
and addressed during this stage.

Aside from the specific technical request, the customer's requirements typically include the
following:

• Timely response to requests for service

• Available personnel to provide service

• Easy accessibility of service or product

• Completeness and accuracy
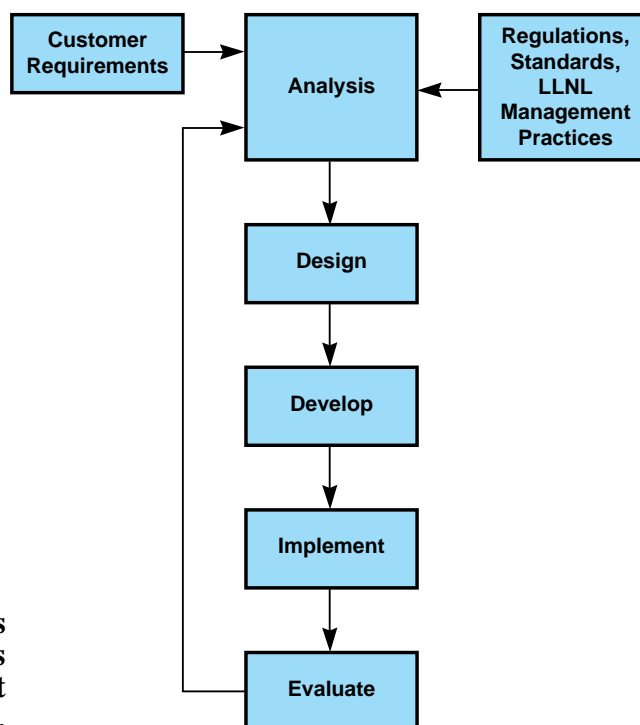
• Budget limitations that affect implementation.

Customers initiate requirements both directly and in response to HCD H&S guidance activities.
HCD reviews and initiates changes in products and services in response to considerations such as
customer surveys, trends or number of incidents, new regulatory requirements, organizational goals,
objectives and future plans, major changes in the scope of jobs and/or tasks, shortages of qualified
personnel or other changes in the composition of the work force, facility modifications (existing and
planned), technological changes, job performance deficiencies, and training not yet available on tasks
that affect safety and reliability or that are difficult to learn on the job.

The first key to designing new H&S services and products is a clear and early understanding of
customers' needs while folding in applicable regulatory requirements and the protection of property
and the health and safety of employees and the public. An equally important key is the quality of sub-
ject matter experts who analyze, design, and deliver the service or product.

These customer requirements form the input into the primary key process used for designing
new services and products and for controlling service/product delivery, as shown in Fig. 2.1.1 and
expanded in Fig. 5.1.1.

Qualified professionals in the respective health and safety disciplines analyze and translate these requirements into proposals for policy and procedures that meet regulatory requirements and standards, or into proposals for R&D projects. A peer review is usually performed at this stage.

When a final draft is completed, the customer is brought in to discuss and review the draft proposal to ensure that an acceptable match is made to the customer's needs and constraints (e.g., budget, resources and time). The institutional perspective from Laboratory management, oversight, and quality assurance (QA) are also brought in at this junction. A final version is negotiated and approved by all relevant parties.

Customer Requirements → Analysis ← Regulations, Standards, LLNL Management Practices

Analysis → Design → Develop → Implement → Evaluate

Figure 5.1.1. New product and process development flowchart. Location and types of reviews are dependent on type of product or process (see §5.1a, §5.1b, and §5.1c).

Table 5.1.1. New product and process flow description.

Steps	Activities

Analysis	Review policies and procedures, regulatory requirements and national standards, and LLNL management practices
	Analyze internal and external needs including:
	    Task analysis
	    Customer inputs/outputs
	    Performance standards
	    Quality standards
	    Support requirements–department elements, customers, and outside suppliers (if needed)

Design	Formalize analysis, examine results, and produce designs Select best design

Development	Develop proposal
	Conduct peer review
	Review:
	    By customer to match budget, resources, and deadlines
	    By institutional elements to ensure alignment with institution's mission and policies
	    Plan pilot/customer-employee feedback

Implementation	Finalize deployment plan with customer involvement and begin service
Evaluation	Monitor customer and employee feedback and quality measures, cycle time and productivity, and compare to standards Maintenance—monitor feedback for quality, productivity, and customer satisfaction. Correct to design standards as needed TQM/CI—compare results: standards, alternate technology, customer input, and make identified improvements

5.1a(2) Requirements translated into processes. HCD uses a systematic approach to process development that is outlined in Fig. 5.1.1 and briefly described in Table 5.1.1. This systemic approach can be applied generally to any specific process, and not all input elements need to be included. Emergency response, field support by the ES&H Teams, H&S training classes, updates and revisions to the *H&S Manual* and other guidance, and other miscellaneous services may have different requirements but the management of the analysis, design, development, implementation, and evaluation/improvement processes are similar. The following example illustrates the analysis process.

The ET&SA Group addressed two customer-identified needs—just-in-time training and challenge examinations—and designed new approaches to delivering training.

Initiation of just-in-time training was requested on the customer satisfaction survey. It is now offered in a number of formats: CBT, formal classroom, self-study, seminar, and one-on-one. The process used for design in Fig. 5.1.1 is referred to as Training System Development (TSD) as applied to performance-based training (PBT). The analysis phase consists of determining a need for training, conducting a job evaluation, and prioritizing training needs. Once the need for training has been established, the hazards expected in a workers' routine job are evaluated and will determine the level of training needed. A job evaluation identifies and ranks all the tasks associated with a job. In addition to the job evaluation, the associated risk or lack of satisfactory performance is evaluated.

The second identified need was for challenge examinations. The process outlined above was followed to develop this kind of examination. LLNL was then instrumental in establishing, for radiation protection training, the right to challenge exams and accept exemptions granted for recognized professional certification. This is in line with HCD policy to minimize repetitive training. Analysis shows that the new delivery methods are more efficient and cost effective for both the customer and for ET&SA without loss of quality.

As illustrated above, ET&SA has modified core courses to meet specific needs of customers and tailored a training program based on modules designed for specific duty areas. The first phase of this training approach has been adopted in DOE EH-52. Subsequently, the DOE STOG was instructed to modify their Radiological Worker core training to reflect the LLNL approach.

An example of the analysis of need resulting in a cost-saving approach is retraining for General Employee Radiological Training (GERT). Based on savings in manpower, the use of a biannual handbook instead of classroom or other training yields an anticipated annual savings of $250,000.

5.1a(3) How all requirements are addressed early in the design cycle. In keeping with the expectation of ES&H Excellence and to eliminate the need for re-work, the department assures that all applicable requirements are addressed as early as possible. This is done in a number of ways depending on what is most appropriate for the product.

One of the most effective ways of providing ES&H advice to the programs was achieved by reassigning functional discipline experts, who had been centrally located, directly to the ES&H field teams. Functional discipline experts from other ES&H departments were similarly reassigned. Now technical requirements can be reviewed early and often by the close and direct involvement of these experts throughout the process.

In the development of a new H&S training class, subject matter experts in the various safety disciplines are consulted early in the design phase to ensure all technical requirements will be met. Similar processes are in place for Emergency Management, including partnering with the LLNL Medical Department for coordination of transport and medical treatment services.

In the development of safety policies, a process is in place that will convert a new requirement (i.e., new regulation) to a draft implementation document, which then undergoes a rigorous review and approval process by affected units, both within and outside of HCD. An example of this process follows.

New or revised chapters and supplements to the *H&S Manual* are written by subject matter experts. The first draft is distributed to interested parties inside and outside the HCD for their initial

review. An early involvement by these customers permits them to provide input on issues to be included and to object to proposed procedures for which compliance is not feasible. The second draft is reviewed by the Technical Leader for the discipline area and submitted to the ES&H Working Group, a committee of key customer representatives of Laboratory directorates and management. They thoroughly review the draft from the perspective of the impact on individual directorates as well as on the institution. A draft is then submitted for review and approval to the Laboratory Deputy Director for Operations, and an approved version is distributed throughout the Laboratory for directorate implementation and compliance (§3.2a(3)).

5.1b How products and processes are reviewed prior to launch

Since most products are knowledge-based, a peer review is typically conducted for the best design selected. For proposed procedures and guidance that specify health and safety controls to mitigate identified hazards, a review is performed by the Technical Leader and other peers or the Team/Division Leader. Any guidance that requires a policy interpretation must be reviewed by a Technical Leader. After the development phase, further reviews by the customers and institutional management, along with negotiations if needed, are conducted to ensure their satisfaction and commitment, and alignment with institutional objectives and policies.

If appropriate, a pilot is conducted (e.g., a new training class) to correct faults and improve the effectiveness of training materials prior to full implementation of the program. LLNL has hosted or conducted five course pilots for DOE core radiological control training. Performance objectives based on tasks actually performed by subject matter experts provide measurable standards with which to evaluate trainees.

5.1c How processes are evaluated and improved

The department uses computers to check and archive product and service information for current and future trend analyses. Customer feedback is another key improvement mechanism for HCD products and services, and is used as a basis for determining which designs and processes may be a priority for evaluation and improvement.

Important feedback for in-field products and services, such as safety advice and assistance on operations, comes from H&S Technicians on the ES&H Field Team. These employees work closely with customers and can glean first-hand information on the efficacy of delivery of HCD products and services.

Particularly in the process areas of laboratory analysis and protective equipment, the SMWTs meet regularly to review and improve the design of their processes. They best know their own processes and are empowered to improve them. For example, the Safety Labs Analytical Team increased the accuracy and precision (reproducibility) for the analysis of metals in samples, specifically silver. These results are used to demonstrate the level of confidence in analytical results. One of the methods uses two spiked samples. The spikes have a known quantity of material and are taken through the entire sample preparation and analysis process. By monitoring the recovery of the spiked samples, they found a stability problem with in-house prepared silver spiking solution as a function of time and exposure to light, which caused the quantity of silver to decrease. Exposure to light and length of time also affected samples being analyzed. Several materials and procedures were changed to eliminate this problem: (1) switching to a commercially available spiking solution produced an instantaneous change in the recovery; (2) minimizing exposure of prepared samples and spiking solutions to light significantly decreased the recovery fluctuations. The team also noted that the recovery values decreased slowly but returned to average level. By using the QC chart, they determined that the spiking solution had a 1-month shelf life before going near the lower control limit. Changing the spiking solution on a monthly basis has given recovery results that are very close on reproducibility and more tightly within the control limits (Fig. 6.2.4).

Another example of a process design improvement is the review of LLNL construction project plans. The goal for completion time of construction project design reviews, traditionally set

at 5 working days, was decreasingly attained from 1993 to 1994 (Fig. 5.1.2). Team members involved in the process analyzed the review process, and identified the following as critical obstacles: routing delays, insufficient data, low priority status, serial instead of parallel reviews, and too few copies of large drawings. An aggressive effort to overcome these critical obstacles improved 1995 performance.

Figure 5.1.2. Percent of design reviews completed within 5 days.
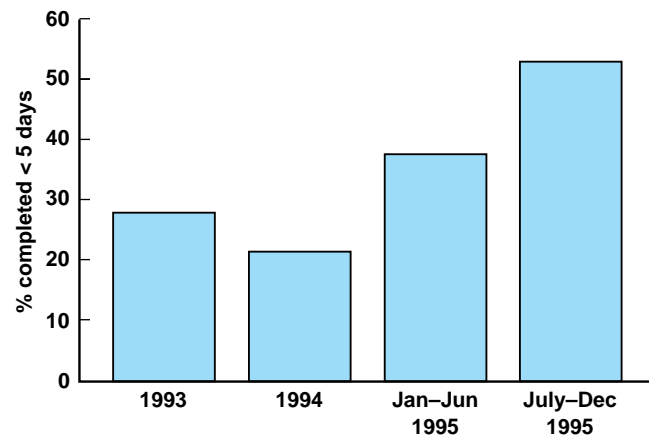
5.2 Process management: product and service production and delivery

5.2a How the company maintains performance in production

5.2a(1) Key processes. The key processes and their requirements are identified in Tables 5.2.1 and 5.2.2, including the primary measures used to monitor and improve them. The key processes are discussed below.

Table 5.2.1. Key products and processes.

Products	Key processes
Safety guidance	Develop safety standards and policies
	Provide safety advice/assistance on operations
Technical support	Educate and train personnel
	Perform laboratory analysis of personnel and workplace samples
	Provide protective/monitoring equipment
Emergency management	Process and handle alarms
	Deploy emergency response resources
	Mitigate emergency situations
Research and development	Conduct safety research

Safety guidance through standards and policy development is the responsibility of the Technical Support and Policy Development Division (TSPDD). They issue standards and policy documents that apply laboratory-wide, generally as revisions or supplements to the *H&S Manual*, in response to recent accident/injury statistics and changes in laws, regulations, DOE Orders, and LLNL operations. Safety advice and assistance on operations is primarily the responsibility of the ES&H Field Teams. These teams are assigned to specific programmatic customers. They provide the front-line customer contact through intimate daily interactions and provide specific advice, assistance, and monitoring, as applicable to individual customer operations.

Technical support includes education and training, laboratory analysis, and protective and monitoring equipment. The ET&SA group has primary responsibility for identifying, developing, and delivering appropriate H&S training consistent with the duties and hazards associated with an employee's job to all LLNL employees. Laboratory analysis of personnel and workplace samples is the responsibility of the eight separate laboratories in the Safety Labs Division: Dosimetry, Analytical, RM Counting, Respirators, Instrument, Calibrations and Standards, Bioassay, and Whole Body Counting Laboratories. Lab services include personnel radiation dosimetry; bioassay analysis; whole body radiation counting; analytical chemistry; radiation measurements; repair and calibration of monitoring equipment; preparation, testing, and issuance of respirators; and the provision of standard safety protective gear such as safety glasses and safety shoes. The Safety Labs follow good QA/QC procedures.

The EMD processes and handles alarms and responds to emergencies. A central dispatch center monitors and receives all fire alarms, takes telephone information on any emergency call originating at

LLNL, and transmits the information to the appropriate emergency response personnel. The EMD also deploys the appropriate personnel and equipment to the emergency scene after an alarm has been processed. EMD personnel act to minimize injury or property damage, render emergency medical treatment if necessary, and ensure containment of any resultant hazards.

Safety R&D is conducted through the SPD. This includes researching, developing, and/or testing of new safety-related products that may be needed due to the unique nature of the hazards and specialized needs of LLNL, DOE, or other outside agencies or customers.

Table 5.2.2. Key process requirements and measures of success.

Key processes	Requirements	Measures of success
Develop safety standards and policies	Clear Effective Timely Efficient	Customer surveys Injury/illness rate Frequency of lost and restricted workdays Turnaround time Cost savings for exemptions
Provide safety advice/assistance on operations	Clear Effective Timely Accurate	Customer surveys Frequency of lost and restricted workdays Radiation exposure rate Injury/illness rate Design review time Technical Leader reviews
Educate and train personnel	Relevant Effective Efficient	Customer surveys Classes offered and completed Student evaluations Incident rate by subject area
Perform laboratory analysis of personnel and workplace samples	Accurate Timely	Accuracy/QA Independent audits Time per analysis Volume of analyses Sample turnaround time
Provide protective/monitoring equipment	Effective Accurate Timely Efficient	Units overdue for calibration Time to provide units Total number of units Units per team member
Process and handle alarms	Speed Accuracy	Response time Review of automatic recording
Deploy emergency response resources	Speed	Response time
Mitigate emergency situations	Effectiveness	Cost/property value protected Review of emergency reports
Conduct safety research	Effective	Customer surveys Peer review

5.2a(2) Measurement plan. The HCD addresses the effectiveness and efficiency of the entire process. HCD identifies issues and problem areas based upon customer and employee feedback, assessments of quality and productivity, and information collected as described for process and results. The Leadership Team reviews overall performance and specific items of performance contained in the strategic and financial plans at its regular, monthly off-site meetings (§1.0), and develops strategies and solutions to improve a key process and service or product.

Key process quality is maintained by monitoring feedback for customer satisfaction and evaluating productivity and product quality. Assessments, evaluations, and employee and customer feedback are utilized and examined to identify weaknesses that are then addressed. The customer performs the activity and provides feedback on the product's applicability and practicability, as well as HCD's performance in supporting the activity. Further requirements for improvement are addressed and the process

is repeated. The process is iterated for continuous improvement. During each cycle, feedback and measures of success are monitored, if possible, to identify areas of weakness.

The Technical Leaders monitor process performance in their respective areas of expertise on an on-going basis through standard measures or observations. Should a measure of a process or result indicate need for further analysis, root cause analysis is normally performed and process modifications implemented as needed.

Although knowledge-based products, particularly those involving professional judgments, can be difficult to standardize, HCD ensures consistency by a number of different means. The Technical Leaders of the various safety disciplines meet frequently with the other members of their discipline to discuss issues and approaches. Peer reviews are conducted in the processes involving research, training, and policies as well as other areas throughout the department. Extensive and formalized training plans are in place and revised as necessary for each employee. Course completions are tracked to the plan to ensure skills are kept current. Cross-training is done to ensure vital skills are always available. The plans include both technical and interpersonal development. The employee-chaired SKA Standing Committee regularly reviews both the skills available within the department and those in need of future development.

In addition to formal classroom training, regular operational drills are conducted for emergency response personnel to ensure readiness and performance to standards for timely and effective response.

Quality of laboratory services are maintained by certifications, audits, self-assessments, and formal QA procedures. All laboratories have controls or standards by which they test and calibrate equipment and monitor their results. All Health Physics and Industrial Hygiene (HP/IH) survey instruments are 100% tested to ensure customer requirements are met or exceeded (i.e., all products and services must meet applicable standards, whether DOE, DOELAP, NIST, ANSI, etc.). Computer databases are used to track individual unit performance and automatically flag less-than-adequate equipment and analytical results.

5.2b How processes are improved

5.2b(1) Process analysis and research. HCD trained several employees as CQI Facilitators, with skills in various methods of analysis. They are available and facilitate as needed to provide guidance to work groups and Standing Committees on various process improvement techniques. The following is an example of re-engineering a process for improved emergency management response time.

A response time goal of 5 minutes to 95% of the emergencies at LLNL was established by the EMD, and the process of emergency response was analyzed according to the process flowchart in Fig. 5.1.1. Two primary components of an effective emergency response were identified and assigned a discrete time allocation: (1) alarm processing and handling and (2) resource deployment. Both had interrelated components that offered opportunities for enhancement.

The team achieved a time of 1.5 minutes for alarm processing and handling by installing a commercially available computer-aided dispatch (CAD) system to automate many tasks formerly performed by Emergency Dispatch Center (EDC) staff. EDC staff workstations were also redesigned for input speed and ergonomics. The time to deploy appropriate resources to an emergency scene was reduced to 3.5 minutes or less by analyzing facility enhancements, apparatus readiness, and equipment and training of emergency response staff, as described below:

- The CAD system now opens the apparatus bay doors, turns on facility lighting, and pinpoints the location of the emergency alarm on radio pagers carried by firefighter shift officers.
- Emergency apparatus is maintained in a constant state of readiness with a standard maintenance and inspection program conducted by firefighters and LLNL maintenance personnel. Bar coding ensures efficiency and the necessary consistency of inspections.
- Routine inspection and replacement procedures are in place. Vendors familiar with the needs of a modern fire department assist in development of specifications for new equipment; efficiency is always to be considered by the specification writer with the end goal of reducing the response time to emergencies.
- A formal training program with regular operational drills, structured classroom training, and regular visits to Laboratory facilities has improved firefighter operating efficiency.

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5.2b(2) Benchmarking. No formal benchmarking program is yet in place although several informal comparisons have been made with outside providers of laboratory services. In these comparisons, the level of service provided by an outside laboratory is lower than that provided by HCD laboratories.

5.2b(3) Use of alternative technology. Numerous processes have been improved or costs vastly reduced due to adoption of recently available technology. Automation was discussed in the previous Computer-Aided Dispatching example. Several laboratory services are now automated or partially computerized and improved by the use of e-mail to send out notices for equipment or personnel monitoring. For example, the number of samples processed per analyst in the Radiological Measurements Laboratory (RML) has consistantly increased since 1992 (Fig. 5.2.1). Leveling of manpower and automated report generation have contributed to the increased efficiency of the RML.
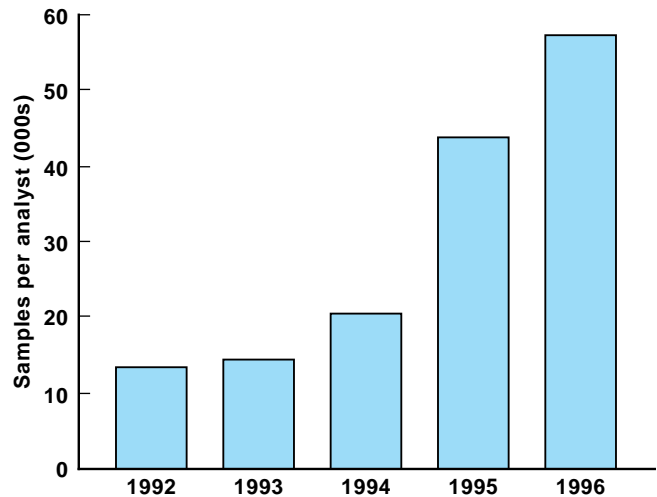
Figure 5.2.1. Radiological measurements efficiency by fiscal year (FY96 projection based on first 6 months).

The *H&S Manual* is now available on the World Wide Web and on LLNL-wide fileservers, saving many dollars in printing and distribution costs, as well as making it available to many more people. Hazards Control is the leader at LLNL in the delivery of CBT. Manhours for training have been reduced and training availability, easy access, and self-testing have all been improved by :

- CBT
- Availability on the World Wide Web
- Electronic presentations.

5.2b(4) Information from customers. The department obtains course evaluations from students and comments from other DOE facilities that use HCD training. The department also gets information from participation on Core Training Maintenance Committees.

Hazards Control personnel provide training for local universities and colleges, outreach groups, and other DOE facilities. The interaction with organizations outside of LLNL provides valuable feedback, both from the technical and the instructional point of view.

The mutual aid agreement between the Fire Department and local fire districts provides opportunities for them to compare and improve processes.

## 5.3 Process management: support services

Support services include the Management Information System Team (MIST) and Administrative Services. These support areas utilize the same process described in §5.1.1. How requirements are determined and the design process is applied are given below for an MIS area requirement and an administrative process redesign project.

5.3a Design of key support service processes

5.3a(1) The sample tracking and reporting (STAR) system. MIST, the HCD team that provides MIS, computer, network, and e-mail support to the department, developed (and maintains) the STAR database. This system was in answer to the Safety Labs requirement for a better functioning, better integrated way of collecting and recording extensive and specific information about samples and reporting analytical results to customers. MIST organized meetings with a diverse group of the different division representatives and users, collected customer data from fact-finding meetings, and categorized and examined the requirements customers and users presented. STAR was created by re-engineering an existing sample tracking and report system. MIST designed the software to include as many of

the specific requests as possible. User manuals and procedures were developed to provide support. Employees were encouraged to test the system and give additional feedback to the developers. Classes were scheduled for users; MIST members were available for individual instruction should the situation require it. The new STAR system was implemented with continuously available instruction and support from the MIST group. Feedback was solicited on a continuous basis through face-to-face interviews, phone conversations with customers, and a survey. Results were used to modify and improve the customer support processes. The design and implementation of STAR employs a barcode to identify, organize, monitor, and track samples collected in the field. User support also includes development of software for specific customer needs, assistance with selection of hardware or software for new or pre-existing systems, repair and recycling of equipment, and partnering with other teams to develop systems of information exchange that can be shared among many groups.

5.3a(2) PAT's redesign of administrative and clerical processes. The Administrative Process Action Team (PAT) develops and improves administrative and clerical processes to effectively meet customer needs in a changing environment while staying within the boundaries of LLNL policies and procedures. The PAT used the HCD support services flowchart (Fig. 5.3.1) to design, deploy, and evaluate new administrative processes. They began by holding brainstorming sessions where representatives from each HCD division communicated concerns and identified current strengths and weaknesses surrounding administrative processes. Future needs and desired products and services were also identified. The following processes were selected for improvement: the department mail system, memo design, department telephone operator backup system, HCD reclassification process, department roster system, department filing system, software for department viewgraphs, department library, methods of communication between divisions and the department office, and uses for the department fileserver. The mail system, whose redesign is described below, is considered a key administrative process because it is an important vehicle for communicating to both internal and external customers.
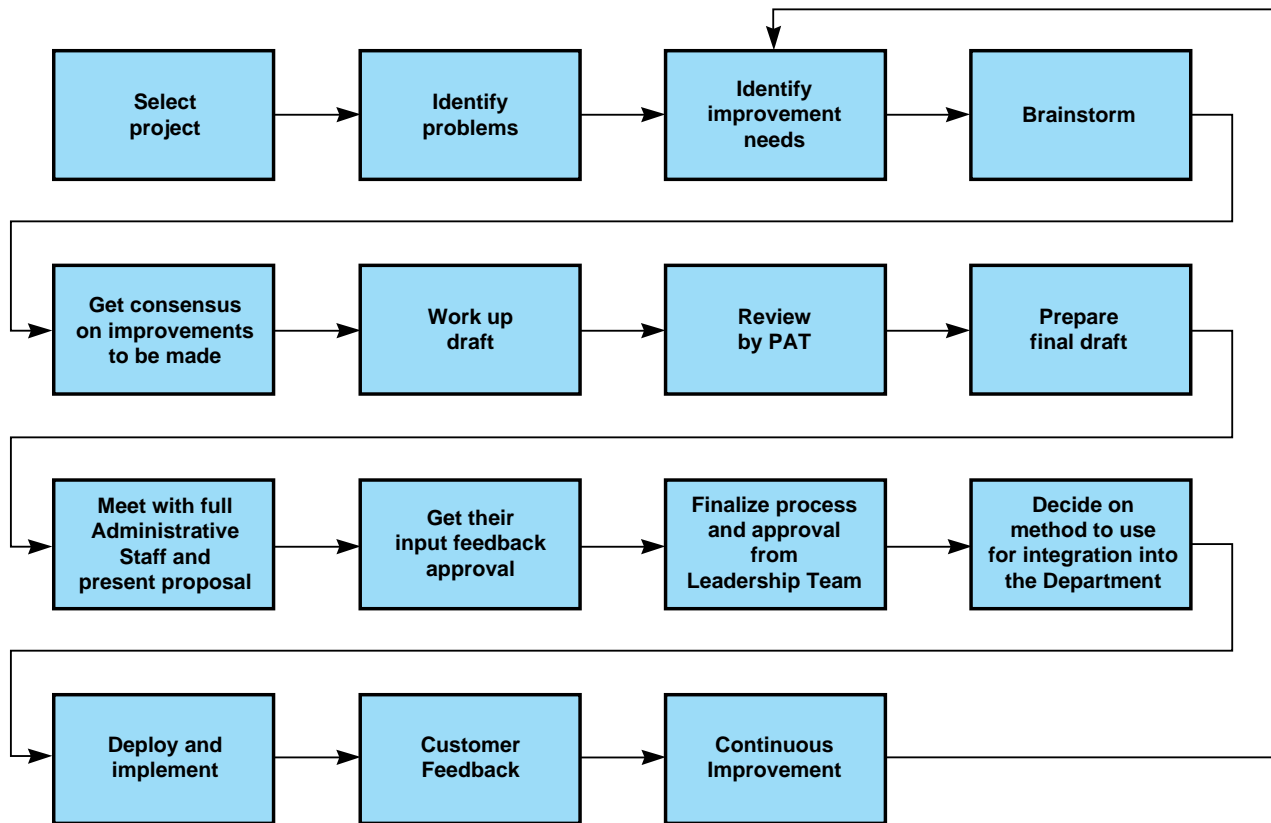
Figure 5.3.1. HCD support services process flowchart.

After meeting with the users, the new mail system design objectives were that boxes be easier to locate, better organized, and easier to maintain. The design process followed was to:

- Write a policy to guide assignment of mail box locations and L-codes
- Establish group mailboxes for remote offices
- Adopt an alphabetical system for individual mailboxes
- Appoint a Mail Custodian to maintain the system
- Develop a schedule and implementation plan for the new system.

Once agreed upon, division representatives submitted the proposed system for review and comment in their respective organizations. Upon conclusion of the review and comment period, the process was finalized and submitted to the Leadership Team for approval. The new mail system was endorsed and implemented.

5.3.b How the company maintains performance

Maintenance procedures are put in place and documented. In the case of the mail system, the Mail Coordinator ensures the continued integrity of the mail system. The mail process is integrated into the department's new employee training for administrative staff. Additionally, this process is documented in the Administrative Staff Desk Books.

5.3c How processes are improved

Feedback from users is solicited for an appropriate period of time following implementation. Feedback is evaluated and used to make improvements. In the case of the mail system, PAT is always on the alert to further improve the mail system through communications at weekly and biweekly Administrative meetings where problems or complaints within the individual divisions are reported.

5.4 Management of supplier performance

5.4a Summary of company requirements

A variety of specifications and requirements for suppliers are in use. These depend upon the specific activities in an area but generally follow LLNL, UC, and DOE procurement policies and any applicable national standards or codes. In the Safety Labs, customer health and safety depend on the quality of items like personnel respirators, which are a very important safety barrier. To ensure the integrity of all these units, a 100% test policy is in effect. LLNL procurement policies require written specifications and third-party certification that national standards of quality (ANSI, NFPA, etc.) are followed. Sporadic local testing may be performed but no routine assessment or feedback has been given to suppliers.

In the training program, vendor-supplied materials must meet the requirements for core training as defined by DOE. Materials that are not used in core training must satisfy the requirements established in the design phase. Vendor-supplied materials are reviewed by the lead instructor, and may be accepted, rejected, modified, or exempted from certain requirements. The HPT Coordinator approves and documents exemptions for purchased training materials that do not meet the requirements of this program but which meet the following criteria:

- Written objectives cover identified training needs
- Content adequately supports the written objectives
- Items have training value as determined by the HPT coordinator.

The Safety Labs procure machinery used for scientific analysis of samples based upon reviews of technical journals for state-of-the-art equipment capabilities and information obtained at seminars conducted for training or to demonstrate new equipment and methodologies. The principal requirements for the main equipment suppliers are quality, price, maintenance, and technical support. Management of the relationship with suppliers has traditionally been through personal interaction between a company representative and the person in each lab that operates the specific piece of equipment the majority of the time. Supplier performance is discussed with the representative at the time of scheduled preventative maintenance or at the time that repairs are requested.

Ongoing relationships with the same companies over the years have not been characterized by written documentation. Maintenance logs and repair calls are noted in equipment anomaly logs only. Companies have provided training for new equipment when purchased or when additional training or refresher classes were requested. Phone conversations or site visits also are used to discuss methods or procedural development for operations.

Federal procurement regulations are a major factor in limiting the selection of suppliers HCD can utilize. Traditionally, companies that have been selected in the past will be selected in the future. It is possible to write in specific requests on a purchase order; however, this does not ensure that the requested item will be obtained.

5.4b How the company improves supplier performance

Services provided by LLNL organizations, such as the Plant Engineering Heavy Equipment Shop or even facility maintenance services, that could negatively affect HCD's capability to deliver a service according to standards are subject to HCD QA procedures. Full acceptance testing of critical components is required after extensive maintenance or repairs. Cost comparisons are done each year between organizations inside LLNL vs. procurement from qualified outside vendors to ensure cost effectiveness.

In the training programs, core materials supplied by DOE are reviewed by STOGs. Feedback on completed courses is sent to DOE and to the STOGs.

Supplier relationships and performance in the Safety Labs are not formally documented. Face-to-face interaction during scheduled maintenance visits or repair calls and phone conversations to plan future activities are the most frequently used methods of communication. New equipment training and demonstrations are usually provided by the equipment suppliers.

Supplier and partner coordination and requirements are summarized in Table 5.4.1. For example, HSD gathers the information needed to make reports of injuries and illnesses to the BLS. HCD personnel are writing software that will allow HSD nursing staff to enter reports directly into a common database. Personnel from both departments continue to cooperate on the ergonomic illness problem, with significant success as measured by reportable illness and severity rates (§6.3.3). Vendors for safety and computer workstation glasses, laser safety glasses, respirators, and safety shoes provide quality products with rapid delivery dates. Product quality of glasses and respirators is measured by 100% inspection. For safety shoes, reliability and adherence to ANSI standards is required. An active complaint process ensures that shoe quality is maintained. The selection of first aid training from a vendor certified by an external organization reduced training time for everyone who maintains a first aid certification by four hours every three years. EMD has partnerships with other fire departments in the local area (§1.3).

Table 5.4.1. Coordination with suppliers and partners.

| Item	Supplier/Partner (P)	Standard or Activity
Illness/injury statistics	HSD gathers information and supplies to HCD (P)	Write software; generate and send reports to BLS
Safety eyeglasses (laser, computer workstation)	Various suppliers	Perform 100% inspection; set delivery schedule
Whole Body Counter	Various suppliers	Service response time; reliability in field
Mobile RML (Belarus)	NAI Directorate	Design and fabrication of mobile radiation measurements
Dosimeters and samples	LBNL (P)	Provide standards, services
Safety Shoes	Various suppliers	ANSI Std.; complaint procedure
Respirators	Various suppliers	100% inspection
First Aid Training	Various suppliers	Certification
Fire Fighting Equipment	Various suppliers	Standards, local testing (§1.3)
Oversight Pilot Program for DOE Auditors	LBNL, LANL (P)	Set 2-week period; coordinate topics
Training programs	UC, LANL, LBNL, EPD/LLNL (P)	Combine resources; some common programs

6.0   Business Results

6.1 Product and service quality results

6.1.1 The number of lost and restricted (L/R) workday cases per 200,000 person hours at LLNL has been steadily declining since the first quarter of 1993, significantly below the BLS 5-year average for general industry (Fig. 6.1.1).

6.1.2 and 6.1.3 HCD began ergonomic evaluations of RMI at computer work stations in 1991. After identifying the customers at greatest risk, the department targeted additional resources in these areas. In 1993, HCD measured the frequency and severity of RMI and overexertion resulting in back and other injuries, helped implement a Laboratory-wide corrective action plan, and promoted the reduction of these injuries by UC and LLNL management as a contract performance measure.

As anticipated, the frequency initially increased (Fig. 6.1.2) as employee awareness and new safety programs focused attention on these areas. However, the severity of these injuries dropped dramatically as HCD increased management and employee awareness through ergonomic evaluations of workstations, ergonomics safety training classes, *Newsline* articles, and evaluations for the purchase of new equipment (Fig. 6.1.3). The department's Industrial Safety Engineers have performed over 500 work station evaluations per year since 1992. In 1994, HCD began training evaluators from the programs to perform their own workplace evaluations.

6.1.4 In 1980, HCD and LLNL management identified electrical shocks as a hazard that needed special attention. The department investigated, wrote Safety Wises on electrical safety issues, participated on the Electrical Safety Committee, conducted workplace inspections, increased employee awareness through *Newsline* articles, and provided electrical safety training courses. The number of electrical shocks has been declining since 1991. However, during the last two years, the number of potentially lethal electrical shocks increased significantly
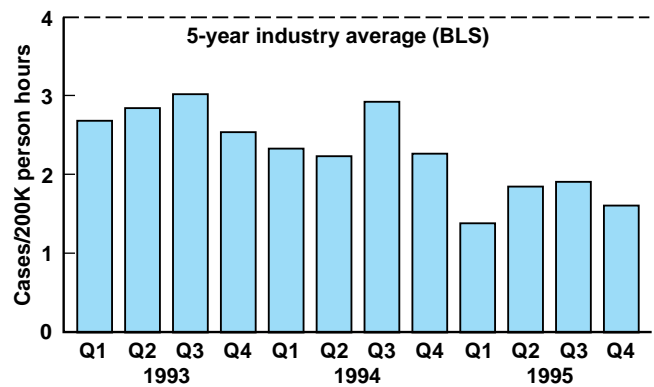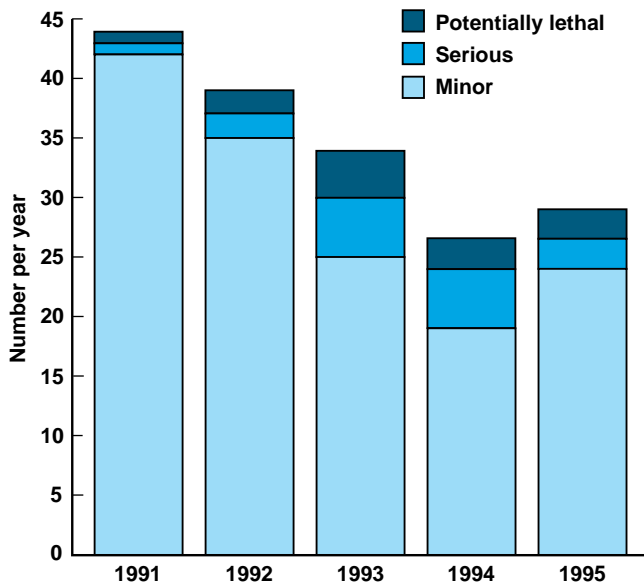

Figure 6.1.1. Frequency rate of lost and restricted workday cases.
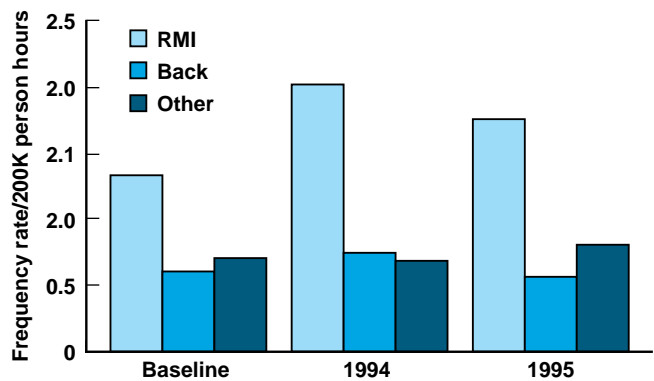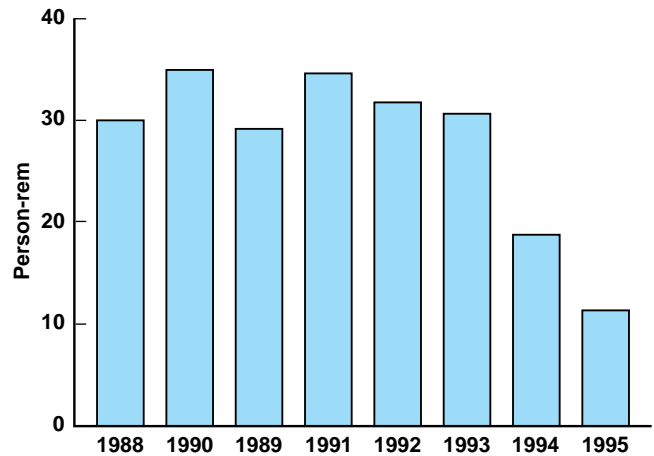

Figure 6.1.2. Frequency rate of repetitive motion injuries (RMI) and back and other overexertion injuries.
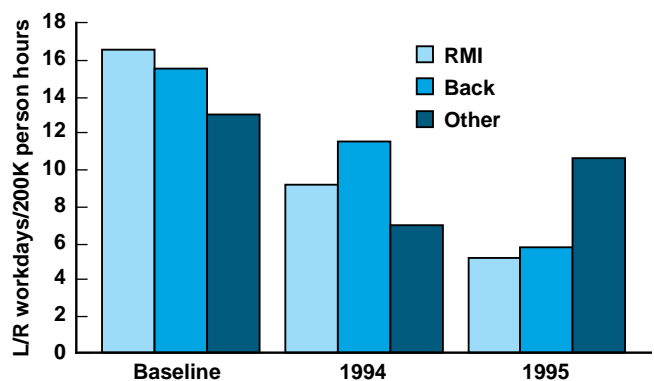
Figure 6.1.3. Decreasing severity rate of RMI and back and other overexertion injuries.

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Figure 6.1.4. Incidence and severity of electrical shocks at LLNL.

Figure 6.1.5. Declining collective annual external radiation dose.

(Fig. 6.1.4). In response, HCD launched a new campaign of safety awareness briefings, *Lessons Learned* publications, a draft on-the-job (OJT) electrical safety training policy, and a Web-based electrical safety training course. HCD now chairs the Electrical Safety Review Committee that replaced the previous LLNL committee.

6.1.5 LLNL aggressively minimizes employee occupational radiation dose. One 1993 UC performance measure was to reduce collective annual external occupational radiation dose by at least 5% per year from the previous 5-year running average. Dose reduction was achieved in 1993, a year in which exposures would otherwise have increased because of the major inventory reduction effort in the plutonium building where 85% of all exposures occur (Fig. 6.1.5).

6.1.6 Guidelines that keep occupational doses as low as reasonably achievable (ALARA) below regulatory limits are established for each employee who could potentially receive >100 mrem/y. Plots of employee hand and whole body radiation dose (Fig. 6.1.6) are given to the supervisor and the employee on a quarterly basis. This accurate record of accumulated annual dose is used to plan employee work activities (adjusted for the type of work performed) to keep occupational doses within the ALARA guideline.

6.2 Company operational and financial results

6.2.1 An important measure of the effectiveness of any emergency response organization is the time it requires to provide vital assistance at the incident scene. The first moments are crucial in minimizing damage to property and maximizing the success of life-saving actions. The Fire Department has set a goal of five minutes from the time an alarm is received by Emergency Dispatch until arrival of emergency personnel and equipment on the scene. Figure 6.2.1 demonstrates that the department has successfully met the 95% goal in six of the last eight months. The goal was based on the typical standard for local communities and is an aggressive one taking into consideration LLNL's critical and unique facilities, potential losses, and the size of the site. As a comparison, the City of Livermore has just started using a five-minute response metric with a goal of 90% compliance—a figure that HCD achieved in all 16 of the past 16 months.
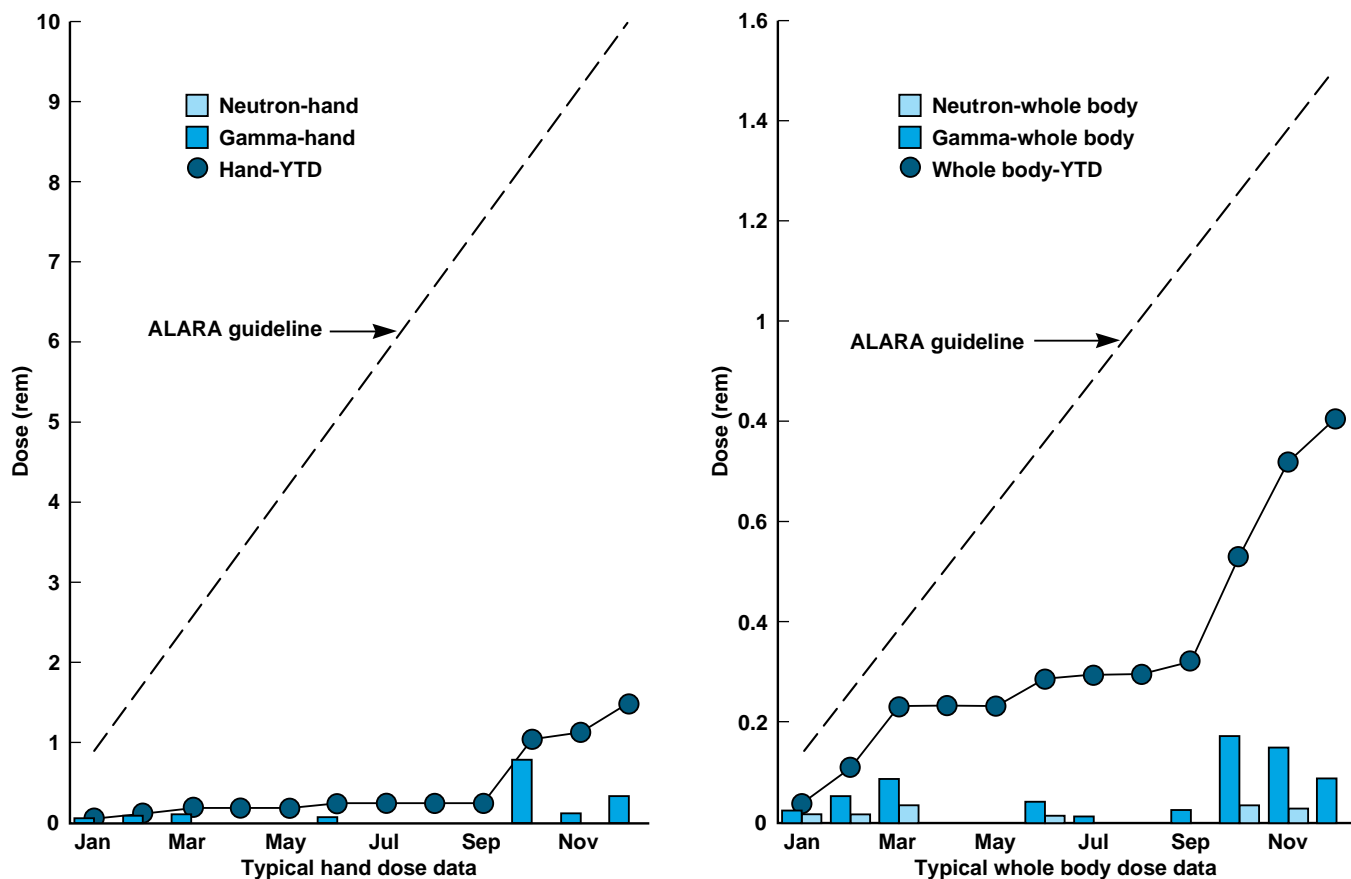
Figure 6.1.6. Annual hand and whole body dose received by an employee vs. ALARA guideline.
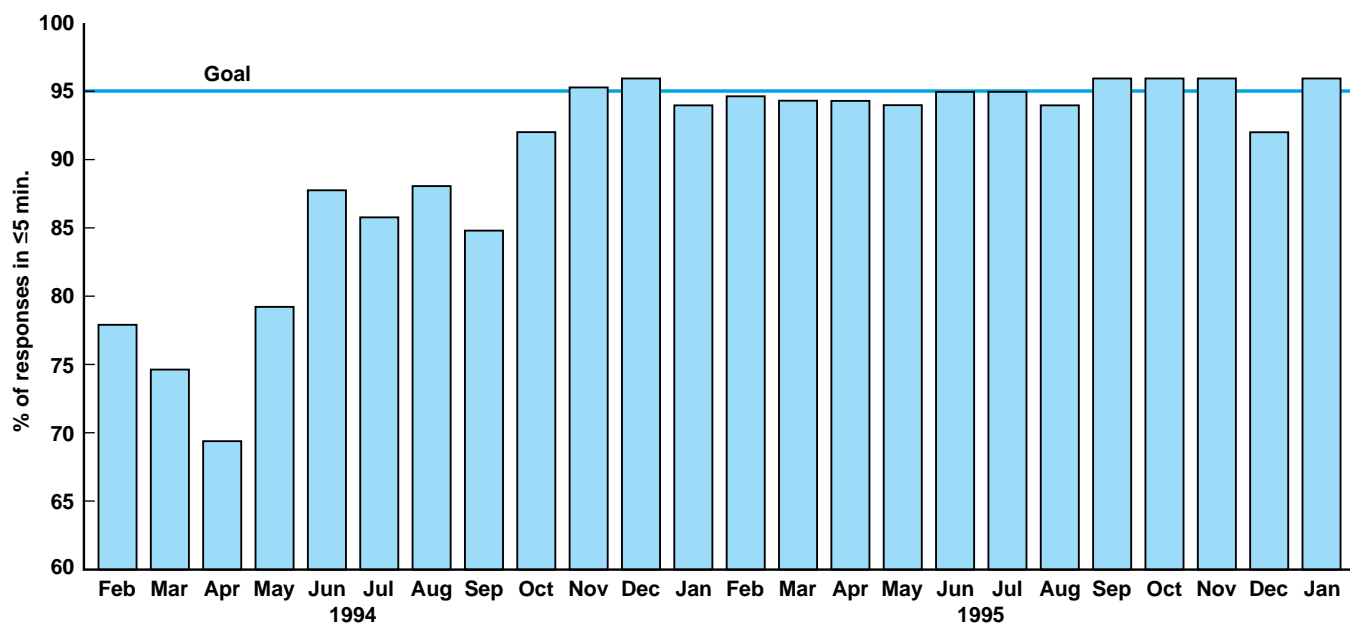

Figure 6.2.1. Fire department response to emergencies.

6.2.2 The HCD uses the latest technology to provide H&S Training for LLNL employees. This is a direct response to employee requests for more training options. From 1994, when the department started using CBT, the number of CBT courses nearly doubled and the number of students taking CBT training nearly tripled (Fig. 6.2.2). In 1995, HCD put five training classes (e.g., lock and tag, electrical safety, pressure safety) on the Internet. Now employees can take these courses from their offices or from home. The department plans to continue to expand these training options aggressively in 1996.
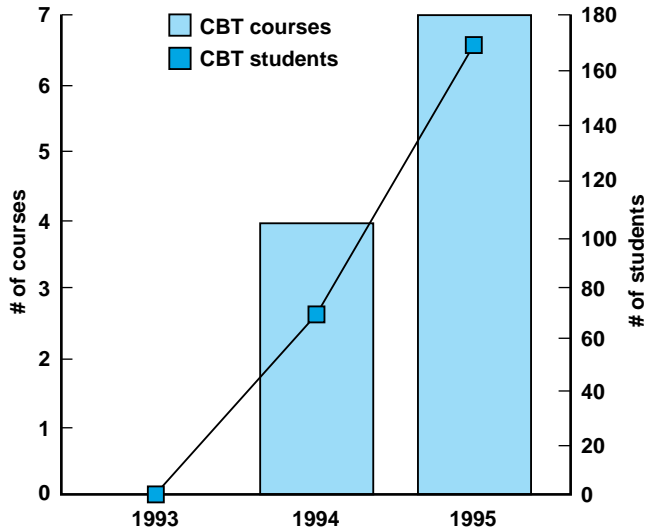

Figure 6.2.2. Increase in availability and use of CBT and Web-based training.
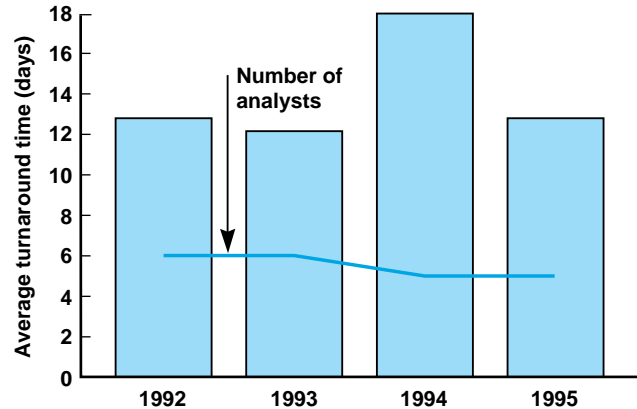
Figure 6.2.3. Turnaround time for analytical laboratory samples.

6.2.3 One of the primary metrics for an analytical laboratory is sample turnaround time (Fig. 6.2.3). In 1992 and most of 1993, the Analytical Laboratory had six employees. In October 1993, the department reduced the staff level to five and introduced SMWTs. The immediate result was a 50% increase in the sample turnaround time. In 1995, sample turnaround time dropped back to the 1992-93 level in
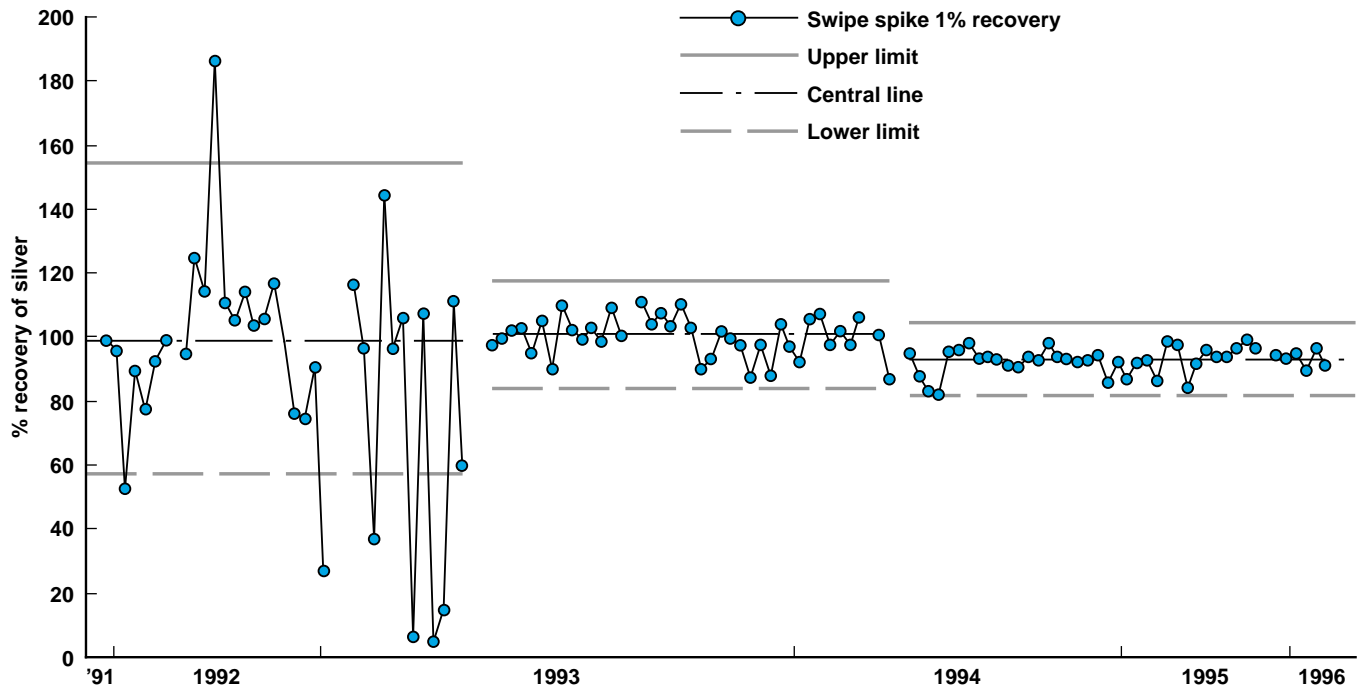
Figure 6.2.4. Improvements in QC and the analytical procedure improved the precision and accuracy of silver analysis controls.
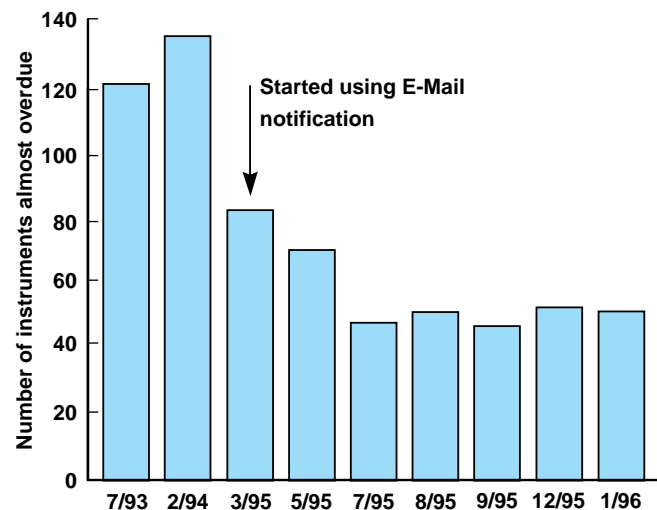
spite of staff reductions, demonstrating the increased efficiency of SMWTs. In addition, the Analytical Team can negotiate rush sample turn-around times with customers, and meet them 99% of the time.

These improvements with a reduced staff are even more remarkable when considering other changes. For instance, sample analyses have gotten more complex and time consuming (e.g., increased number of pump oil analyses with 17 metals to test for; more organic analyses). A more stringent QC program also increased the analyst workload.

6.2.4 With an active QA/QC program, the Safety Labs Analytical Team improved the accuracy and precision with which they report the analysis of silver in samples. Improvements made in the quality control of standards and in the chemical analysis procedure tightened control limits (Fig. 6.2.4).

Figure 6.2.5. Instrument calibration status.

6.2.5 The CSL services and calibrates approximately 1800 portable radiation survey instruments annually. Though calibration is valid for 12 months from the date of service, instruments are returned for service every 9 months so the 12-month limit is never exceeded. The Almost Overdue Report lists instruments that have not been serviced for at least 11 months. Starting about a year ago, CSL started sending service notifications by e-mail rather than hard copy. The result is a dramatic decrease in the number of instruments that are almost overdue (Fig. 6.2.5).

Table 6.2.6. Cost saving measures.

| Cost-saving measure	Description	Costs saved or averted
Convert the DOE *RadCon Manual* into a guidance document	Members of HCD spearheaded an effort with support from UC, LANL, and LBNL to convert the DOE *RadCon Manual* (RCM) from a compliance to a guidance document. This allows the RCM to be implemented in a cost-effective manner at LLNL and other DOE contractor sites. The cost averted is estimated to be $2M/y at LLNL alone.	$2M/year
Implement an electronic version of the *ES&H Manual*	An plan had been developed to write a combined ES&H Manual to contain both the *H&S Manual* and the *Environmental Compliance Manual*. Costs for rewriting and integrating both documents were estimated at about $3M. The cost to implement the electronic version of the *ES&H Manual* on the Internet with interlinking between topics was about $200K	$2.8M
Reduce the staffing of the fire department on selected shifts	Fire department staffing has been reduced from four to three firefighters on certain shifts by not filling in with overtime for firefighters that are on sick leave or vacation. The selected shifts will be off normal work-hour shifts at the Livermore site and at S300 (except during the fire season).	$283K/year
Modify the underfloor fire protection requirements for high value computers	Until recently, DOE required that floor spaces under computers with a value of more than $1M be protected with active fire suppressant systems in addition to fire detection systems. Because of the lack of fire experience in floor spaces under computers, HCD was successful in increasing the threshold for active fire suppression to $10M. This will result in a cost averted of $200K.	$200K

Table 6.2.6. Cost saving measures. (Cont'd)

Cost-saving measure	Description	Costs saved or averted
Replace SARS with PHAs for lower hazard facilities.	An agreement was reached with DOE that Preliminary Hazards Analyses (PHAs) would suffice for lower hazard facilities rather than performing detailed Safety Analysis Reports. The cost per facility of performing a PHA is about $10K and the cost of performing a SAR is about $70K.	$60K per low hazard facility every 5 years

6.2.6 HCD aggressively identified areas where ES&H program costs can be reduced while still maintaining a high level of safety support for LLNL. The major cost savings are summarized in Table 6.2.6.

6.2.7 The department General and Administrative (G&A) funded manpower level has remained basically flat since 1994, and the staffing level has declined by approximately 20 full-time equivalent employees (FTEs) since reorganization in 1993. The reduction was made possible through increased efficiencies of operation and adoption of the flat organizational structure, and was accomplished in spite of increased requirements, new and changed DOE Rules and Orders, and additional oversight by DOE and the DNFSB (Fig. 6.2.7).
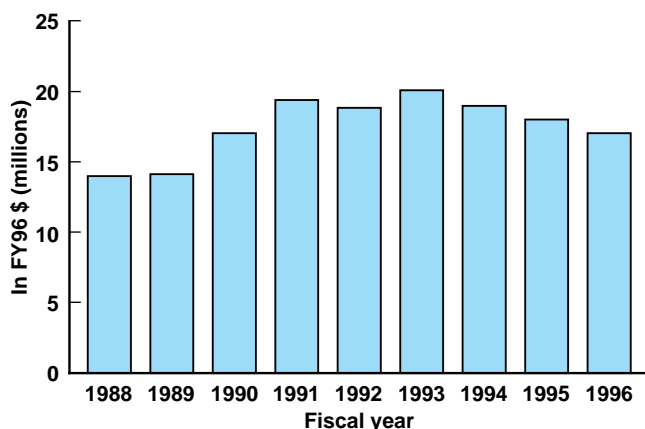
Figure 6.2.7. Cost savings from reorganization.
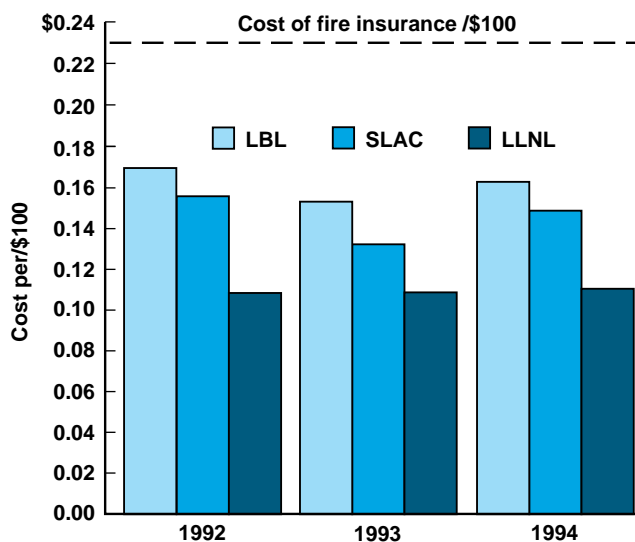
Figure 6.2.8. Cost of insurance per $100 value vs. cost of Fire Department protection.

6.2.8 LLNL is uninsured for property loss resulting from fire. This, and the unique and critical nature of many of the facilities, places a premium on the effectiveness of the LLNL fire fighting capabilities. The DOE policy historically has been that it is worth maintaining a high level of fire protection if the cost of providing this service is less than the cost of fire insurance. To ensure cost effectiveness, HCD evaluates fire protection as a ratio of cost to the value of property protected, which at $0.11/$100 is less that one-half the estimated cost of fire insurance ($0.23/$100). As shown in Fig. 6.2.8, the cost of fire protection at LLNL also compares very favorably with the cost of providing protection at other comparable DOE facilities.

Table 6.2.9. Special Projects Division funding.

| Project	Sponsor	Funding $ (000s)				
		1992	1993	1994	1995	1996
Radon progeny	UC Berkeley	146	87	111	–	–
Cleanable steel HEPA filter	DOE-HQ	1291	998	100	3	150
Heat/flame ensemble test	FEMA	100	86	68	–	–
HP/IH tech. support	DOE-HQ-EH-41	500	775	1200	727	78
HP/IH tech. support	DOE-HQ-EH-31	800	925	560	200	–
DOELAP program	DOE-HQ	100	150	120	100	100
Belarus trailer/γ system	DOE-ALB (NAI)	–	130	1214	981	1477
B332 stack sampling	Weapons	150	79	523	293	22
Filtration tech. support	Weapons	300	300	525	275	350
HEPA filter standard	DOE-HQ	–	150	150	150	200
Pilot exposure project	DOE-HQ	–	–	125	200	–
Occup. exp./Be monitor	DP	–	–	300	370	200

6.2.9 SPD receives no institutional overhead funding. Customers for specific projects with diverse applications provide the sole source of funding for this division (Table 6.2.9).

6.3 Human Resource results

6.3.1 On a 1995 internal survey of the HCD employees, one of the questions was "how often have you been satisfied with your job?" The responses are tabulated in Fig. 6.3.1.
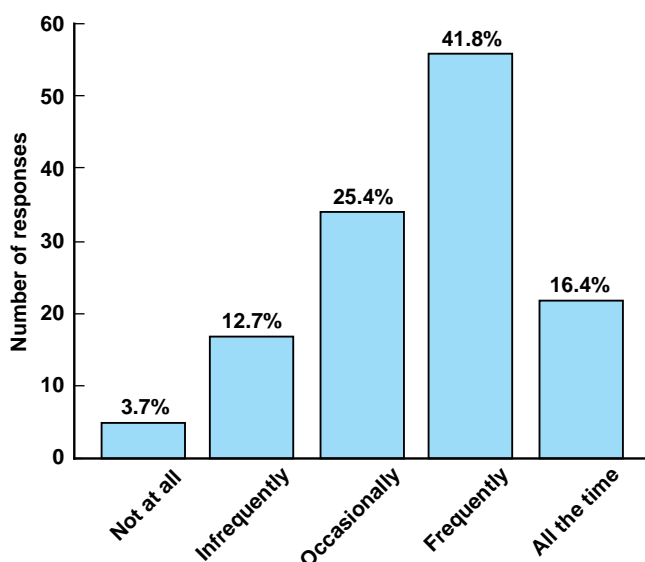
Figure 6.3.1. Internal HCD survey.
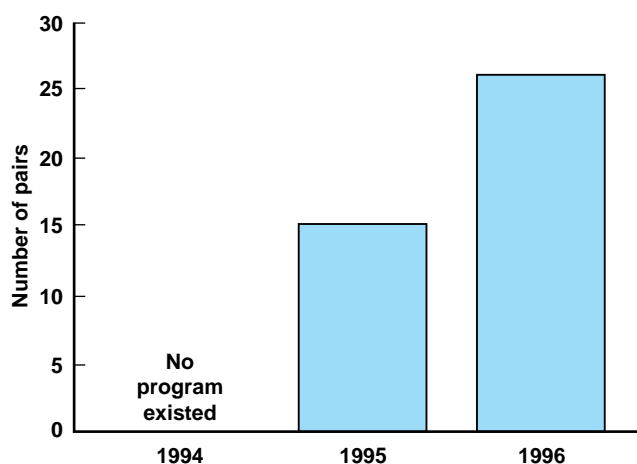
Figure 6.3.2. Number of mentor/protégé pairs participating in HCD Mentoring Program.

6.3.2 The current mentoring program has 26 pairs of employees, up from 15 pairs who participated in the pilot program (Fig. 6.3.2). This program helps employees develop technical, administrative, and personal work skills. It also encourages cross training to increase employee value and add flexibility to the department.
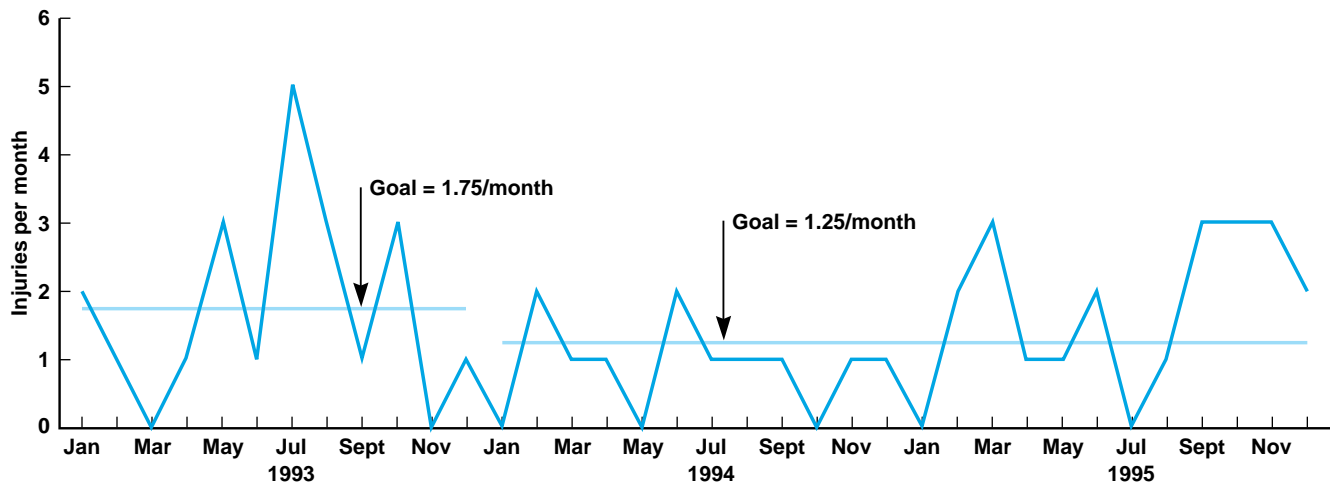
Figure 6.3.3. Total recordable injury/illness case rate.

6.3.3 In 1993, HCD identified the total recordable injury/illness case rate as a performance measure for the department and developed a program to reduce this rate. The goal was changed from 1.75 cases/month in 1993 to 1.25 cases/month (Fig. 6.3.3). The divisions with historically higher rates were identified, and ES&H Team 4 worked with those division supervisors on ways to reduce injuries and illnesses.

7.0   Customer Focus and Satisfaction

The department serves four sets of customers: institutional, program, field, and sponsors or other government agencies or entities. The institutional customer base is set by the nature of the UC–DOE contract and LLNL matrix operations. Within that context, HCD provides safety and health support for the entire Laboratory. With its multidisciplinary capabilities, the department also supports the varying needs of the programs at LLNL, individual ES&H field workers, and other organizations outside the Laboratory.

7.1 Customer and market knowledge

7.1a Determining expectations and requirements

The key methods for obtaining information about customers and their needs and expectations, are based on integrating multiple sources of input. When merged, these requirements are weighted in relative importance based on safety and health risk, mandatory regulations, and cost. Two major business factors—the dynamic nature of R&D and the ever-changing ES&H regulatory environment—require an information-gathering approach that is adaptable and flexible. Figure 2.1.1 shows an overview of this process; details about each aspect are described in the following sections.

7.1a(1) How customer groups are determined. The department segments customers into the following groups based on their requirements and priorities:

Institutional (UC-LLNL). LLNL pays HCD approximately $17 million per year to ensure that the Laboratory recognizes and manages safety hazards and meets or exceeds the H&S performance measures in the UC-DOE contract. In addition, internal sponsors (programs or overhead organizations) may also fund some R&D efforts.

Program. The various research and support programs at LLNL fund the staff of the ES&H Teams and some other parts of HCD for services that line management uses to help maintain a minimal-risk work environment.

Field. These are LLNL employees who conduct day-to-day R&D and support functions. Their programs and/or support organizations pay for the HCD services they receive.

Other organizations. These are external non-LLNL entities (e.g., DOE, DOD, USEC, NRC) that fund R&D efforts of the SPD. This segment also includes the jurisdictions and their residents (e.g., City of Livermore, Alameda County, State of California) to whom HCD provides EMD emergency response services (e.g., fire, paramedic, hazardous material spill).

The customer groups who use HCD's primary services are well defined; they usually are UC-LLNL and DOE organizations. The institutional, program, and field customers expect comprehensive H&S technical support and safety services to be provided. Because of the institutional focus of the department mission and contract limitations, the presence of competitors and the potential for new customers is fairly limited.

Table 7.1.1. Identification and weighting of major customer requirements by customer type.

Customer requirements[a]	Institutional	Program	Field	Other
Maintaining a minimal-risk work environment	+++	+++	+++	–
Rapid emergency response	++	+++	+++	–
Compliance with regulations and orders: advice on content; interpretation; policy formulation	+++	+++	+	++
Access to trained and qualified personnel	+++	+++	+++	+++
Direct field support[b]	++	+++	+++	+
Safety education and training	++	+++	+++	–
Safety and health R&D	+	++	–	+++
Satisfying UC contract performance measures	+++	++	–	–
Efficient and economical service	+++	+++	+++	+++

[a]+++ = very important; ++ = important; + = less important.

[b]Review of operations and procedures, hazard identification, advice on protective measures and controls, monitoring and analysis of exposures, safety lab services, program work.

7.1a(2) How information is collected. In 1993, the department formed a Customer Standing Committee that meets bimonthly and often weekly to determine customer needs and satisfaction. Members are from all employee levels (i.e., manager, professional, clerical) and serve a minimum of two years. The chairperson is elected by the members-at-large to serve for at least one year. The committee conducts surveys and advises others in the department about effective survey techniques. This committee is chartered to:

- Develop a means of consistent feedback of department efforts and activities
- Use analytical tools to ensure feedback is accurately reviewed and summarized
- Provide quality assurance for this customer information
- Develop a list of customers and stake holders that includes DOE and other sponsors
- Make recommendations for solving issues raised by customers.

Although the customer base is relatively static, the details of customer needs never are. Obtaining information about customers and their needs is an ongoing process, derived from the multiple inputs shown in Fig. 2.1.1 and discussed here.

Personal interactions. HCD uses a variety of direct personal interactions with existing and potential customers. Field technicians housed in client facilities maintain daily face-to-face contact.

Standing and special purpose meetings are held with all levels of program and institutional managers. ES&H Team Leaders meet weekly with senior program leaders, and meet frequently with operations managers, assurance officers, and budget and resource managers. Weekly meetings of the Department Head and Deputy with the Division Leaders include the exchange of information about ever-changing customer needs. Interaction with UC takes many forms. During negotiations about performance measures there are periodic sessions; a weekly conference call is held throughout the year.

The Laboratory's Senior Management Council has delegated decision making about ES&H policies and implementation to the ES&H Working Group. The most important ES&H issues facing the Laboratory are discussed and resolved by this group. Its members are the department heads of all the

ES&H programs (Environmental Protection, Health Services, Quality Assurance, and Hazards Control), representatives from the Legal Department, and Assurance Officers appointed by each Associate Director. Subcommittees have additional representatives from major research and operational programs. In essence, this group brings most major customer groups to one place. (External customers such as outside agencies do not take part). Other HCD department members may attend these meetings periodically to discuss relevant topics and participate in policy development and implementation. The interactions in these forums are extremely important mechanisms for customer information and building relationships.

In addition to personal interactions with the customer, internal HCD interactions (§1.1a; 1.2a) are also an important method for learning about the customer and sharing information. And a monthly SPD report prepared for each client is used to stimulate interaction. While its purpose is to report progress on task assignments done for a client, it also facilitates the exchange of information. And visits to the client's facility or vice-versa provide yet another means of interaction.

Observations and data. HCD acquires information by working in the field with customers and by analyzing data from illness and injury records and other traditional safety statistics (§2).

Customer surveys. HCD has used the results of formal customer surveys since 1993 to determine customer needs and prepare the department's Strategic Plan. They are also part of the feedback loop for monitoring customer satisfaction.

Analysis of drivers (§1.3). The technical staff of HCD constantly analyzes requirements—the "drivers"—for institutional and operational impact. These are federal regulations, industry codes and standards, DOE Orders, and performance measures in the UC–DOE contract. Institutional policy is also factored into these analyses. LLNL has emphasized a low-risk work environment, and HCD work practices often transcend the minimum requirements. As a leader in the H&S area, HCD is expected to promote a safety culture and advise clients not only of the minimum adequate level of safety, but also of the optimal protection feasible (§1.3a (3)).

Unlike conventional needs assessments based upon the client's expressed needs, HCD proactively keeps customers informed. After analyses are presented to the customer, HCD plans compliance measures, formulates policy, and then determines the extent and cost basis for further actions.

Feedback mechanisms. HCD has instituted several standing feedback mechanisms for client use:
- Customer surveys
- Course evaluations requested after each training class
- Client input requested on individual performance appraisals
- Client comments or questions sent directly to the responsible author via the online *H&S Manual* e-mail system.

The most frequent and trusted source of feedback is from the personal interactions described above because they occur in real time. More details about feedback mechanisms are in §7.2a.

The objectivity and validity of information is attributable to:
- Redundancy because repeat queries about the same issues are made in different environments
- Iterative processes (Fig. 2.1.1, especially the customer feedback loop).

7.1a(3) Specific features and their relative importance. Customer requirements and service needs are collected during many of the activities described in §7.1a(2) above. In addition, the following methods are also used.

Risk, compliance, and cost trade-offs. The integrated information gathering methods described in preceding sections often produce conflicting demands. The business interests of the customer (e.g., budget and schedule) may not be aligned with the safety goal of risk reduction or total regulatory compliance. Satisfying multiple customer groups may also lead to conflicts. The worker on the shop floor (field customer) may desire or need more protection than management (the program customer) wants to implement. These issues are resolved in a give-and-take process through direct client interaction. In

most cases, these require participation by a mixture of technical staff and managers who represent the varied interests. This process helps determine the relative importance to each customer of different services. In the end, services are tailored to each customer's specifications.

Budget planning. HCD monitors the overall DOE budget for the Laboratory and also the budgets of individual research and operating programs to look for large program trends, the amount of DOE money available for H&S R&D, and pressures for redefinition of the LLNL mission. These factors affect the type and extent of services that HCD will be expected to provide. HCD must adapt to major shifts (e.g., from nuclear weapons to stockpile stewardship) by preparing a flexible team mix to address newly emerging H&S issues. The HCD presentations to the Director's CCI exemplify the pressure to manage expenditures carefully in order to provide maximum service at the same or reduced cost. The department's budget planning process (SP Goal 12) was developed to respond to the changing circumstances encountered in recent years.

Individual client budgets and their impact on HCD allocations are discussed by the affected Team Leader, SPD PI, and the HCD resource managers.

Planned outreach. The ES&H Team Leaders prepare annual reports and summaries (§7.1.b) to discuss service needs and determine the relative importance of current and future activities with their major program clients.

SPD makes periodic strategic overtures to its major clients to assess their ongoing needs. One outreach strategy attempts to match areas of technical excellence with the potential needs of HCD customers (SP Goal 5). For example, the SPD, in collaboration with the Non-Proliferation Arms Control and International Security directorate at LLNL, designed and fabricated a self-contained, complete mobile radiation measurement laboratory for the former Soviet Republic of Belarus. Some special R&D services done by SPD require assembling flexible work teams with unique capabilities not readily found elsewhere (e.g., capability to perform classified H&S R&D). HCD has built and maintained one-of-a-kind, state-of-the-art research facilities for fire research, respirator research, advanced air filter development and testing, and aerosol physics. HCD employees also have unique talents and experience that compliment these research facilities. Utilizing the department's personnel and capital strengths, HCD approaches potential customers with unsolicited proposals or contacts them at technical meetings and professional conferences to determine if they have needs in any of these areas.

Interaction on UC contract terms. The department participates in the development of annual performance measures in the UC–DOE contract. A steering committee determines the prime intent of each topical area (Radiation Protection, Health and Safety, and Institution) and its relative weight. Subteams with specialists from the DOE, UC, and LLNL negotiate the content of each objective in each area. This process enables HCD to clearly understand desired goals and their importance.

7.1a(4) How other data are collected. The Communications Committee response form can be returned in either electronic or hard copy with comments or suggestions. There is an ES&H telephone hotline. The accident/injury reports are initiated by Health Services and other LLNL departments. They report the data to HCD for analysis. HCD, in turn, reports the statistics to BLS.

7.1b   Addressing future requirements; learning and listening strategies

The current safety environment for LLNL is rapidly changing from traditional regulation and order compliance to the emerging but still ill-defined "necessary and sufficient" approach with an emphasis on "integrated safety management systems." HCD is interacting with DOE on several fronts as this new style of safety management is evolving. The following major "listening and learning strategies" employed are largely the same as those described in §7.1a(2) and 7.1a(3) but with an emphasis here on how they are used for future planning.

Evaluation of new and proposed regulations, codes and standards. HCD analyzes *newly adopted* regulations and develops implementation plans for the entire Laboratory that are approved and adopted by the ES&H Working Group. The department also looks at *proposed* DOE Orders, federal regulations, and professional codes and standards to influence content and anticipate their impact on programs and institution.

The department has employees who work on national committees for standards and policy development and with DOE to develop content for new orders (e.g., order reduction plan, *Explosives Safety Manual, Pressure Safety Manual, RadCon Manual*).

Budget planning. ES&H Teams give an annual report on activities and status to each program leader in March. This includes information about the past calendar year's activities and resource allocations. The report stimulates discussions about how the team views future activities and their planning impact. In August, the team leaders meet with each program to discuss the next FY budget allocations for field support. The department's budget planning process (SP Goal 12) was developed to respond to changing circumstances.

Maintaining professional competence. Customers expect that the HCD staff will lead in technical H&S matters. Active participation in professional societies, training, seminars, and professional conferences keep the staff aware of changing trends in the H&S field and thus better able to anticipate new requirements for the customer.

7.1c   Evaluating and improving processes to satisfy customers

The iterative process in Fig. 2.1.1 and the description of its elements in §7.1a(2) and §7.1a(3) show that none of the inputs are static over time. There are constant changes in budgets, external factors such as regulations, the UC contract performance measures, and broad workplace trends. Likewise, this process changes. The department has embraced CQI principles in its operations; some of the ongoing changes that resulted include:

- Change in the customer survey from a qualitative, interview style to a quantitative method. Other format improvements were made following training in survey techniques by HR specialists
- Annual review and update of the performance appraisal system is an important part of the customer feedback step
- Tracking customer preferences for the electronic *H&S Manual* vs. the paper version (currently the use of paper is down, electronic is up).

Other methods are discussed in the following sections.

7.2 Customer relationship management

The mainstay of the customer knowledge base is direct client interaction at all levels. The department works to resolve at the lowest possible level any issue that surfaces before it escalates into a formal complaint. The methods and practices described in §7.1 are also used to enhance customer relations. Significant interchange occurs at weekly ES&H Team Leader meetings with program managers [SP Goal 7 objective] and at the weekly ES&H Working Group meeting of department heads. Since 1989, LLNL has had an ES&H hotline to the Laboratory Director's office to use for general assistance, complaints, or feedback.

7.2a How the company provides customers with easy access

A major customer requirement and goal of HCD is easy access. The department structured the ES&H field team approach to this end. HCD believes that easy access is a core value in the Safety business, and the methods used to facilitate it (i.e., query, comment, complaint) are described below:

Query. Customers seeking out information and assistance can turn first to the HCD field personnel housed in client facilities. Hazards Control Assistance (Locator) cards that identify point-of-contact personnel are strategically placed near telephones throughout the LLNL site. The department assigns pagers to field and emergency staff, and uses answering services, voice mail, and e-mail to make it easy for customers to reach department personnel or leave messages. During off hours, a recording machine is active on the main department phone line. At any time (24 hours a day, 365 days a year), the Fire Department Emergency Dispatcher may be contacted for H&S assistance and connection to the on-shift H&S Technician or to a senior HCD department official at home, if necessary. The LLNL phone book has HCD listings by Team number and function (e.g., Material Safety Data Sheet hotline).

Information about HCD operations, the electronic version of the *H&S Manual*, and other policy and guidance information is on an electronic file server (Baloo). Figure 7.2.1 shows how frequently users access the electronic version of the *H&S Manual*. An ES&H hotline has been available since 1989. HCD put a Home Page on the World Wide Web in February 1994 to describe department services, contacts, and links to other ES&H resources (Fig. 7.2.2).
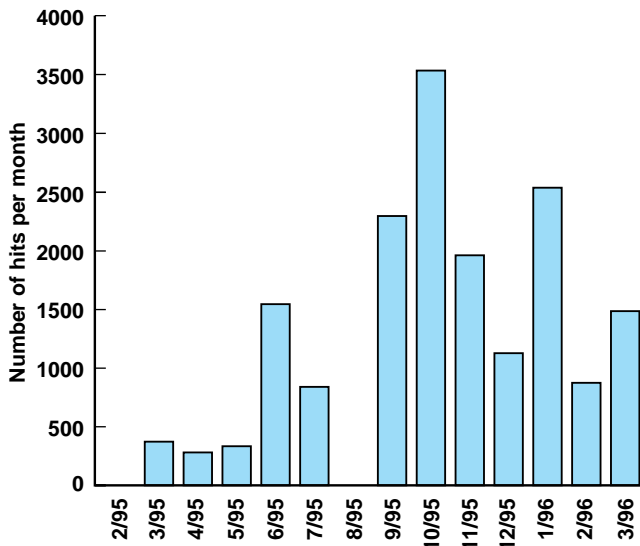
Figure 7.2.1. User access to the electronic version of the *H&S Manual*.
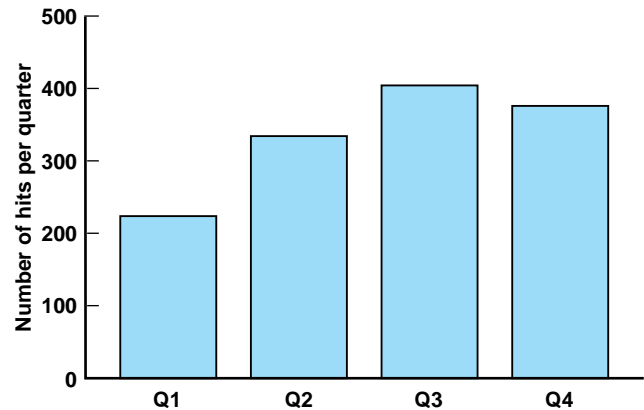
Figure 7.2.2. Hits on the HCD Home Page by quarter since inception in February

Comment. Formal structured feedback is solicited through annual customer surveys (three have been conducted since their inception in 1993). Contact points for each H&S topic are published in the *H&S Manual*.

Complaint. Department employees are instructed in New Employee Orientation to escalate problems when there is a safety concern or dissatisfaction with service. If the complaint is not resolved by working with the immediate supervisor, the employee is instructed to continue to push the issue up through the department, the LLNL Director, or to DOE, if necessary. Bulletin board holders (OSHA boxes) contain a job safety poster, HCD Hazard Evaluation forms, and DOE complaint forms that can be submitted anonymously to address unresolved H&S issues. When received (about one per year), forms are tracked through completion. The Laboratory also provides Dialogue forms for the same purpose. They are used periodically for H&S concerns and are managed through the Director's office.

Should it be necessary for a customer to complain about an individual Hazards Control employee, the complaint can be noted in the employee's performance appraisal by contacting the employee's supervisor.

7.2b How the company ensures that all complaints and feedback calls are resolved

The complaint management system attempts to resolve each issue at the first interaction with the customer. Field staff training emphasizes technical skills, easy access, and face-to-face relationships to enhance problem solving. If the person contacted does not have the ability or authority to effectively correct the problem, he or she is encouraged to go directly to the person with the proper technical knowledge, ability to change a process, etc., so that a minimal number of steps are involved. In more complicated technical or policy matters, a gradual escalation process is used. Formal, written methods using HCD Evaluation Request forms or the LLNL Dialogue process may also be used. That they are rarely used indicates that the informal interaction process works.

Patterns or trends that may affect multiple areas are analyzed and shared through *Lessons Learned* or Safety Wise notices.

Team leaders participate in the Plant Engineering/EPD/HCD Joint Working Group to resolve institution-wide problems involving these three departments. ES&H Team 4 is the point of contact for working on specific measures involving these items (SP Goal 4).

7.2c How the company follows up with customers

Customer follow-up is informal in most cases, fitting with the HCD approach of working on issues at the lowest and most efficient level. Formal methods include customer surveys and training course evaluations. The SPD sends monthly progress reports to sponsors. These are used to follow up any issues about performance quality with the customer.

Team Leaders and Deputy Team Leaders meet regularly to ensure ideas are being addressed consistently between the ES&H Teams. Team Leaders meet individually with the TSPD leader on a periodic basis to address issues, including customer and regulatory needs that may result in new services (SP Goal 7 objective). The internal HCD meetings mentioned in §7.1.a (2), §1.1.a, and §1.2.a are also useful for exchanging information and building good relationships.

7.2d How the company evaluates and improves customer relationships

7.2d(1) Improvement of service standards. Regularly collected metric data and surveys of customers and employees are used to improve service standards. For example, when looking at electric shock incidence, and comparing it with historical LLNL and industry standards, the department implemented new training and documentation to bring this rate back down.

7.2d(2) Aggregation of customer comments. Customer comments are collected in a variety of ways, including telephone, face-to-face interviews, field team reports, and surveys. HCD responds immediately to field reports and takes appropriate action.

7.3 Customer satisfaction determination

7.3a How the company determines customer satisfaction

Customer satisfaction is measured by direct feedback. Satisfaction is implied when customer needs are met or requests are completed without complaint or incident. Customers may not express satisfaction after effective performance (e.g., a decrease in injury rates). Performance improvements from a service organization such as HCD are often taken for granted. While negative consequences can be measured (e.g., fire loss), it is difficult to quantify how many injuries or illnesses have been prevented by an effective program. Thus, customer satisfaction successes are measured in the following terms:

1. Decreasing risk and losses in the workplace

2. Renewing contracts with external customers; funding increases from internal customers

3. Meeting or exceeding the ES&H-related performance measures in the UC-DOE contract

4. Meeting the expressed needs of customers (e.g., providing better training).

7.3a(1) Description of process. In §7.1a(2), five main categories of learning customer needs were presented. Four of these (Personal Interactions, Observations and Data, Customer Surveys, and Feedback Mechanisms) also are major methods for determining customer satisfaction and dissatisfaction, and whether or not HCD activities bring success (i.e., reducing risk in the workplace and providing quality service).

Other measures of success include stewardship of the customer's financial support (i.e., on-budget, on-time) and requests for additional work. Table 7.3.1 shows how HCD measured customer satisfaction compared to customer needs (*cf* Table 7.1.1) as both hard evidence from contract renewal, funding, and customer surveys and soft evidence from meeting expressed needs and verbal feedback.

Table 7.3.1. Methods used to determine customer satisfaction.

Attribute of Success/Satisfaction	Type[b]	Measurement	Frequency
Maintaining minimal risk environment	I,P,F	Injury/illness rates/exposures §6.1.1, 6.11.2, 6.1.3, 6.1.5	Ongoing
Rapid emergency response	I,P,F	EMD response time §6.2.1	Monthly
Increased funding levels	I,P	Overhead FTEs §6.2.7; Team FTEs §7.4.2	Annual
Renewed contracts for service	O,P	SPD item §7.4.5	Annual (typical)
Meet or exceed UC performance measures	I,P	LLNL/UC/DOE scores §7.4.1	Annual
Improving education and training[a]	I,P,F	Interaction–response to CBT program §6.2.2	Each offering
Providing efficient and economical service[a]	I,P,F	Closing on budget	Annual
		Outside lab comparisons	As needed
		Customer survey §7.4.3, 7.4.4	Annual
Accessibility, compliance, field support[a]	I,P,F	Interaction/feedback	Ongoing

[a]Meeting expressed needs.
[b]Customer types: I=Institution; P = Program; F = Field; O = Other.

7.3a(2) Customer future behavior. Customer satisfaction is not easily coupled to future planning. The department's future is largely driven by the budget from Congress to the DOE. This is two steps removed from HCD and its primary customers. Consequently, each year the department repeats extensive budget planning and work prioritization processes with customers.

Ironically, the UC contract performance measures are made more difficult each year. Each successful item brings a tougher challenge the next year.

7.3b Satisfaction relative to competitors

7.3b(1) Company-based studies. Competitors for on-site H&S services are limited by LLNL policy and the UC contract. Thus, formal benchmarking against competitors has not been particularly necessary although it has been done for the analytical laboratories (§7.4).

7.3b(2) Studies made by independent organizations. A group of national-level ES&H experts conducted a peer review of the effectiveness of the HCD program and commented on current pressing issues.

LLNL self-assesses specific measures of performance for the UC-DOE contract; UC and DOE do the same. The three sets of scores are used to compare the independent analyses and to calibrate the internal scoring systems.

7.3c How the company evaluates and improves satisfaction determination process relative to competitors

Competition is not a significant factor in HCD business activities. The department occasionally examines parameters like analytical laboratory costs, making sure that like services are being evaluated.
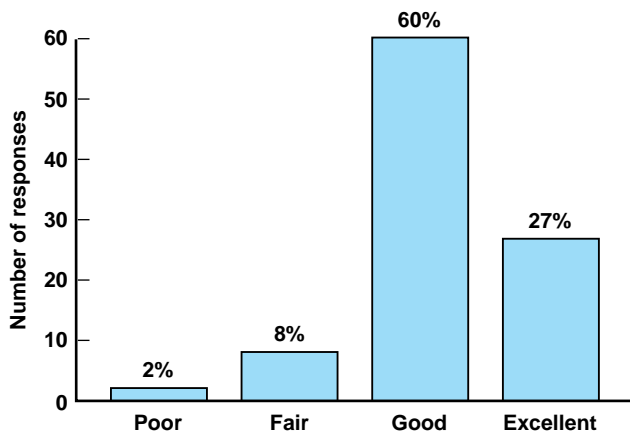
7.4 Customer satisfaction results

7.4a Current levels and trends of satisfaction

7.4.a(1) Customer satisfaction. The following sections address customer satisfaction by each customer group and its needs (*cf* Tables 7.3.1 and 7.1.1).
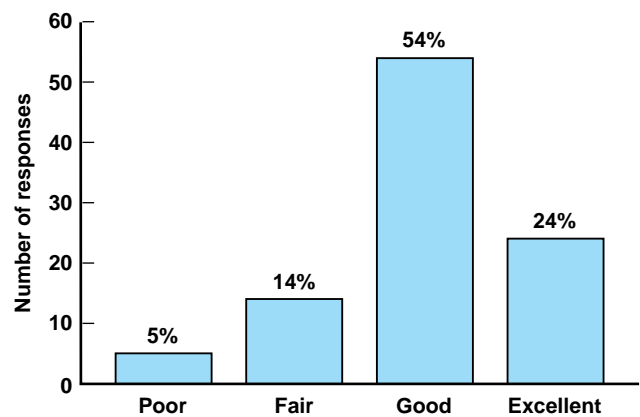
Field customers. This group is most interested in reduced risk in the workplace, rapid emergency response, and meeting their expressed needs. Customer satisfaction at the field services level has been

determined primarily by one-on-one feedback. The ongoing verbal and occasional written feedback mechanisms indicate that support services are well received. Field customers have the following needs:

- **Minimal risk.** Figures 6.1.1, 6.1.2, 6.1.3, 6.1.4, 6.1.5, and 6.1.6 show trends in reducing losses and exposures.

- **Rapid emergency response.** Figure 6.2.1 shows how well HCD has met the emergency response time goal. Three customers are particularly well satisfied. In September 1994, the Fire Department improved its emergency medical response to allow immediate treatment of persons suffering cardiac arrest. During the first 6 months, four lives were saved by newly certified paramedics.

- **Meeting expressed needs.**

  (1) Education and training improvements—Verbal and written evaluations administered after newly implemented CBT courses have been extremely favorable. Supervisors have enrolled their workers and workers have recommended these courses to their coworkers.

  (2) Accessibility and field support—The 1995 customer survey indicated no noticeable drop in service following the HCD internal reorganization, and 87% of customers rated the qualifications and effectiveness of HCD personnel as good to excellent (Fig. 7.4.1) and 78% rated HCD guidance as good to excellent (Fig. 7.4.2).


Figure 7.4.1. Customer satisfaction rating of H&S personnel (qualifications and effectiveness).

Figure 7.4.2. Customer satisfaction rating of H&S guidance (consistency, accuracy, timeliness).

Program customers. This group's primary interests are much the same as those of the Field Customer group with an additional concern for efficient and economical service. The FTE allocations (Fig. 7.4.3) from the programs to the ES&H Teams indicate that customers continue to purchase field team support, expending programmatic funds in addition to LLNL overhead, even at a time of declining budgets. While these data appear to be flat, they represent a relative increase in support levels. HCD efficiency improved over this time period, and the department has consistently underrun amounts budgeted for program support.

Figure 7.4.3. Even with lower budgets, program customers continue to purchase Field Team services.


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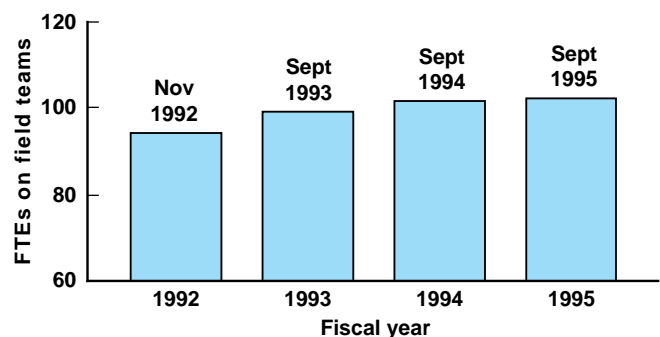
Institutional customer. The institution has needs similar to those of the program and field customers, but in addition, requires efficient and economical service regarding the budget provided by the AD for Plant Operations. The institution has the following needs:

- **Efficient and economical service.** Table 6.2.7 shows how G&A FTE levels have changed in light of shrinking LLNL budgets. In late 1995, the Director's CCI review of department activities concluded the following about the efficiency and impact of HCD operations and budget:

  The HCD manager has exhibited leadership, creativity, and experimented with a new organizational structure, with what seems to be appropriate goals. HCD has changed their ratio of supervisors to employees from 1/6 to 1/15 between FY93 and FY95.

  The desire for efficient and economical service often prompts comparisons between Safety Laboratory support and that available from external analytical and support services.

- **Satisfy UC contract performance measures**. For the past three years, the UC contract performance measures have been evaluated. (A qualitative system that does not exactly correlate was used in 1993; it is not shown in Fig. 7.4.4). LLNL self-assesses performance and scores itself, as does UC. These measures are also scored by the DOE. This overlapping process validates and verifies that the objectives are being addressed. Each year the expectations are made more difficult, so an increase is particularly significant. Five of seven categories have shown improvement from 1994 to 1995, and in two, HCD performance far exceeded expectations at >90% (Fig. 7.4.4).
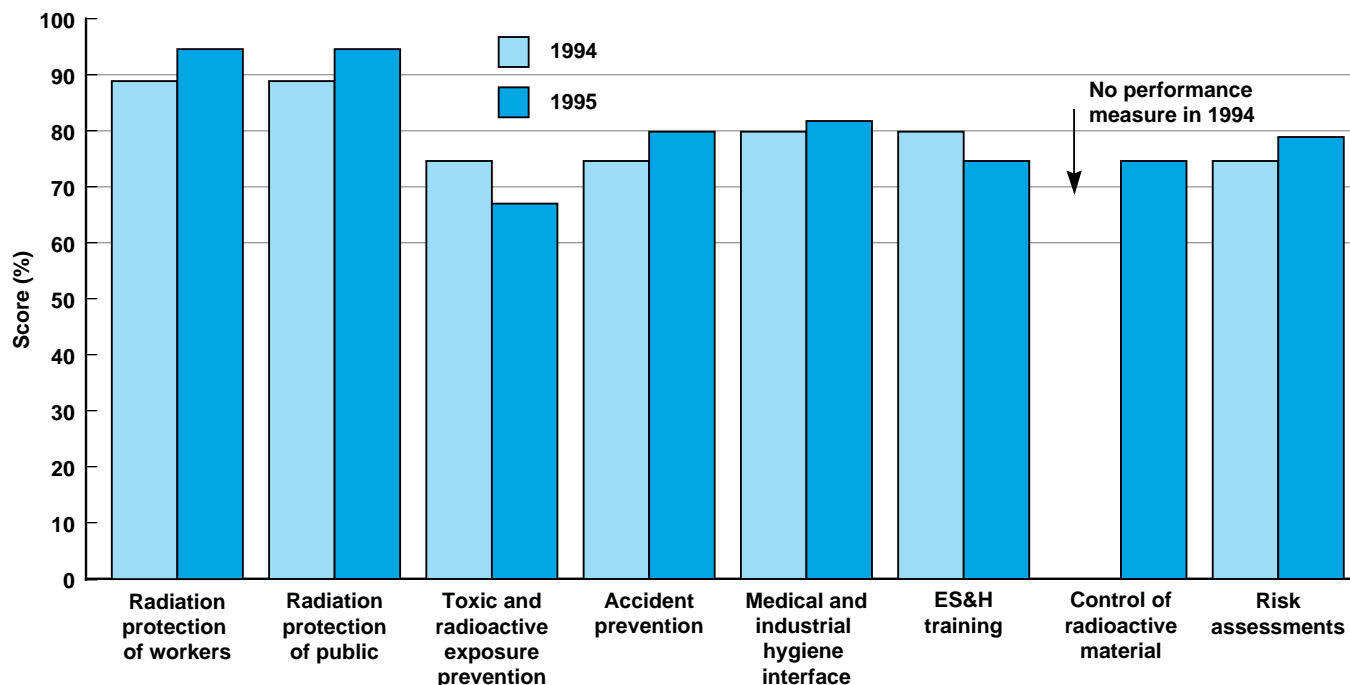
Figure 7.4.4. Scores on the UC performance measures related to ES&H.

Other organizations. External customers (i.e., those outside the normal field team allocations or outside LLNL) express their satisfaction by renewing contracts or changing year-to-year funding to multiyear contracts. From FY92 to 95, there was continuing support from DOE Environmental Programs (EH-41) but it dropped in FY96 because of their loss of funds and reluctance to commit what they had received as protection against mid-year budget cutbacks. DOE Defense Programs has provided ongoing project work in several areas. This year, there will be an additional $1 million from the U.S. State Department to build variations of a mobile radiation measurements laboratory for use in Belarus. HCD has also received ongoing funding to prepare toxicological profiles of materials used in weapons.

7.4.a(2) Customer dissatisfaction. Dissatisfaction with service efficiency, quality, or economy is expressed by attempts to outsource field support (including the Fire Department) or analytical laboratory work. To date, customer use of outside organizations for service has been very limited because after initial trials they find that HCD provides superior returns in timeliness, comprehensive capabilities, emergency response, and cost.

Another method for expressing dissatisfaction is the ES&H hotline to the Director's Office. It is seldom used (a few times per month), mostly by individuals seeking information, not to express a complaint.

Customer Surveys measure customer dissatisfaction. The results from the 1993 customer survey led to reorganization of the department. For example, this survey showed that some individuals thought the disciplines were not accessible. As part of the reorganization, disciplines moved to field teams, where customers see them on a regular basis and they provide support face-to-face rather than on the phone.

7.4b Levels and trends in customer satisfaction relative to competitors

Many institutions can provide H&S research. HCD's SPD excels in a few areas that fit the mission of HCD and LLNL. As such, HCD is unique in the nation for certain types of H&S R&D, and does not compete with universities who may be able to work cheaper. Competition is limited and benchmarking has not been useful.

The major competition HCD experiences is potential outsourcing of services; requests from customers for cost comparisons are made fairly regularly. Competition is also introduced by sponsors who find providers other than HCD to perform their work.

At present, no competitors are employed here. Some LLNL programs have either used them in the past or considered doing so. After evaluating cost, schedule, flexibility, and technical competence, these customers usually decide to stay with HCD; even if they use a competitor, they generally return. The initial cost-only comparison is usually break-even, but when emergency response and ability to deviate from standard methods is factored in, the HCD product is superior. Three examples follow:

- During a recent period, Kaiser Engineers was contracted to perform safety inspections at a fixed cost per square foot of facility. After some months of experience, the customer determined that service was not comprehensive, their staff was not as technically qualified, and there were many hidden costs (e.g., Xeroxing) that became evident later.

- Although the U.S. Enrichment Corporation (a government corporation that manages the uranium enrichment process developed by LLNL) has the option of contracting H&S support through supplemental labor, it uses HCD. One staff Health Physicist has been hired, but only to address issues during design of their planned new facility (location not yet selected).

- H&S support at the Pantex plant for weapons disassembly work could have been provided by local resources but ES&H Team 3 staff was selected to provide multidisciplinary support and accompany LLNL weapons staff to Texas to work side-by-side with them. The Defense Technologies Engineering Division of LLNL nominated several members of ES&H Team 3 to receive the Weapons Recognition of Excellence Award which was presented by Rear Admiral Charles Beers for efforts during the following incident at Pantex. During the disassembly operation to remove high explosives (HE) from a W48 pit at Pantex, the pit cracked. The pit had explosive still bonded to it and was radioactively contaminated due to access to plutonium through the crack. An LLNL team prepared procedures; installed contamination control equipment, including a glovebox with atmospheric control; and associated support equipment to remove HE from the pit and prepare it for shipment. This operation was successfully completed in January 1993.

External experts reviewed the department's ES&H program in November 1995. Their comments on its adequacy relative to current national standards in industry and research were:

> *. . . overall, a thorough, well organized Hazards Control Department, Environmental Protection Department and Health Services Department with all participants committed to the excellence of their programs.*
>
> —*Peer Review Panel*